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THESIS

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OF A NATO GROUND FORCES CAMPAIGN
IN KOSOVO**

by

Armin D.W. Dirks

June 2000

Thesis Advisor:	Thomas W. Lucas
Co-Advisor:	James G. Taylor
Second Reader:	Douglas J. MacKinnon

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On March 24, 1999, the North Atlantic Treaty Organization (NATO) started an air campaign by attacking targets in Serbia, including Kosovo. This thesis analyzes the question: "What might have happened if Serbia had not retreated and NATO had had to conduct a ground forces campaign to achieve its objectives?" The aggregated combat model uses the situational force scoring (SFS) methodology, introduced by RAND, to compute force ratio, attrition, and movement as the result of combat. For a portion of the campaign analysis, the General Campaign Analysis Model (GCAM™), developed by *Systems Planning and Analysis, Inc.*, is used. It is shown that a NATO ground forces campaign in Kosovo will only be successful, if tactical and technological measures can reduce significantly the defender's use of anti-tank (AT) weapons; even then, the casualties on the attacker's side are relatively high. Furthermore, the developed model is a starting point for the development of a decision support tool for joint contingency planning in higher HQ.

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CAMPAIGN ANALYSIS OF A NATO GROUND FORCES CAMPAIGN IN KOSOVO

Armin D.W. Dirks
Captain, German Army
M.S., Bundeswehr University Hamburg, 1986

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

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ABSTRACT

On March 24, 1999, the North Atlantic Treaty Organization (NATO) started an air campaign by attacking targets in Serbia, including Kosovo. This thesis analyzes the question: "What might have happened if Serbia had not retreated and NATO had had to conduct a ground forces campaign to achieve its objectives?"

The aggregated combat model uses the situational force scoring (SFS) methodology, introduced by RAND, to compute force ratio, attrition, and movement as the result of combat. For a portion of the campaign analysis, the General Campaign Analysis Model (GCAM™), developed by *Systems Planning and Analysis, Inc.*, is used.

It is shown that a NATO ground forces campaign in Kosovo will only be successful, if tactical and technological measures can reduce significantly the defender's use of anti-tank (AT) weapons; even then, the casualties on the attacker's side are relatively high. Furthermore, the developed model is a starting point for the development of a decision support tool for joint contingency planning in higher HQ.

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EXECUTIVE SUMMARY

On March 24, 1999, the North Atlantic Treaty Organization (NATO) started an air campaign by attacking targets in Serbia, including Kosovo. Afterwards it was discovered that the overall number of 37,200 sorties had provably destroyed only 26 tanks, 12 infantry fighting vehicles (IFV), and eight howitzer batteries. To date, the exact cause of the Serbian withdrawal has not yet been determined.

This thesis analyzes the question: "What might have happened if Serbia had not retreated and NATO had had to conduct a ground forces campaign to achieve its objectives?" The evaluation satisfies two measures of effectiveness (MOE): minimizing friendly casualties and successfully ending the campaign as soon as possible. Furthermore, the created model is a starting point for the development of a decision support tool for joint contingency planning in higher HQ.

The data and information of this campaign analysis are based on unclassified sources. The level of this campaign analysis is the NATO command level for such a campaign, i.e. Supreme Allied Commander Europe (SACEUR) level. Thus, this study limits its resolution to the level of divisions for the Blue Forces (NATO) and to the level of armies for the

Red Forces (Serbia); simultaneously, the guerilla warfare element is taken into consideration. Although such a campaign would be a joint one, this study focuses on the ground forces.

A brief history of the Balkans contributes to the reader's understanding of the conflict in this area. These nations have suffered seven hundred years of political and civil oppression, resulting in countless wars with alternating coalitions. Historically, the mutual violence could only be suppressed when strong political leadership could form a united organization. The hatred, however, was not eliminated—only left dormant. As soon as the "iron clamp" ceased to exist, the violence among the Balkan nations erupted again.

This paper's aggregated combat model uses the situational force scoring (SFS) methodology, introduced by RAND, to compute force ratio, attrition, and movement as the result of combat. The SFS methodology is a force-on-force methodology which adjusts scores dynamically by considering the effects of the type of terrain, the type of battle, and the combined arms imbalances—or shortages.

For a portion of the campaign analysis, the General Campaign Analysis Model (GCAM™), developed by *Systems Planning and Analysis, Inc.*, is used.

Based on a preceding study and the study of the German Invasion of Yugoslavia in 1941, the scenario chosen for this thesis reflects a combination of the "Macedonia Option," the "Montenegro Option," and the "Albania Option;" i.e., the invasion into Kosovo and southern Serbia out of the Former Yugoslav Republic of Macedonia (F.Y.R.O.M.), Montenegro, and Albania.

The overall concept of operations (CONOPS) for a NATO campaign on the Balkans, which includes ground forces, is divided into four phases: a deployment phase (deployment of NATO troops in assembly areas close to the ports of embarkation), a forward deployment phase (deployment of these troops close to Serbia's borders), an air campaign (air strikes in preparation of the land campaign), and a ground campaign (attack of NATO ground forces into Kosovo).

The land part of the CONOPS includes the engagement of four divisions. Based on the availability of data and the efficiency of the operational approach, the author has chosen one division from each Germany (GE), France (FR), the United Kingdom (UK), and the United States of America (US).

The Serbian Army consists of three armies with eight army corps, three task forces, and several air defense and artillery units. Additionally, a Special Forces Corps (only

in peace time under army command) and a corps-sized Belgrade Defense HQ are available.

A key factor for warfare in the Balkans is the rugged and mountainous terrain. It prevents mechanized forces from displaying their high-tech based superiority and enables the defender to withstand supposedly superior equipped enemies. The terrain even allows the defender to use rather old equipment effectively.

The result of this campaign analysis shows that a NATO ground forces campaign in Kosovo will only be successful if tactical and technological measures can reduce significantly the defender's use of anti-tank (AT) weapons; even then, the casualties on the attacker's side may be relatively high. With these type of weapons, indirectly the enormous large number of Serbian infantry troops is reflected.

Finally, with the developed spreadsheet—containing the implementation of RAND's SFS methodology—the basis for a decision support tool for joint contingency planning has been made.

I. INTRODUCTION

A. THE NATO AIR CAMPAIGN AGAINST SERBIA IN 1999

On March 24, 1999, the North Atlantic Treaty Organization (NATO) started an air campaign by attacking targets in Serbia, including Kosovo. The goal was to end the "ethnic cleansing" in Kosovo and coerce Serbian forces to withdraw from Kosovo. More than 11 weeks later, on June 11, 1999, NATO halted its air campaign because Serbia had agreed in a military treaty with NATO to an immediate withdrawal of its forces from Kosovo. Within the following weeks, NATO forces investigated roughly 900 of the engaged targets in Kosovo. It was discovered that the overall number of 37,200 sorties had provably destroyed only 26 tanks, 12 infantry fighting vehicles (IFV), and eight howitzer batteries [Ref. 1]. Furthermore, a number of civilian targets were erroneously attacked. These civilian casualties jeopardized NATO's credibility inside and outside Europe and endangered the unity of the Alliance [Ref. 2].

B. BACKGROUND

Since the end of the Cold War, especially after the Gulf War, NATO's tendency to overestimate material and technological effectiveness had significantly increased.

Contrary to the lessons learned from World War II, Korea, Vietnam, the Middle Eastern Wars, and Afghanistan, the Kosovo campaign was based solely on air power. It was NATO's intention to conduct a clinically pure and predictable air campaign from a safe distance. Targets should have been destroyed with terminally-guided weapons. Simultaneously, friendly casualties and collateral damage would have been minimal.

Clearly, this situation demonstrated that computer-controlled high technology, which works well under laboratory conditions, has limitations in a real battlefield. Poor weather conditions, some geographical peculiarities, and an enemy, who was tactically well prepared, significantly reduced the effectiveness of the air campaign. The slight influence of the air campaign on the outcome of NATO's actions is seen, at best, only as one factor among many that determined the outcome of the conflict [Ref. 3].

Fog and low clouds caused multiple terminations of air strikes and reduced the efficiency of electro-optical satellite systems, infrared based reconnaissance, and the laser/GPS based navigation of cruise missiles [Ref. 4]. Furthermore, contrary to the Gulf War terrain, the mountainous, rugged terrain of former Yugoslavia reduced the

ability of long-range reconnaissance. From the Gulf War, the Serbian Forces had learned that only reconnoitered targets could be engaged. Thus, hidden tanks, IFV's, howitzers, and "silent" radar sites could not be engaged to a significant and desired extent. In addition, the deployment of decoys prolonged the survival of the real, mostly hidden, equipment.

To reduce their own casualties, which was essential for the continuous unity of 19 democratic NATO nations, the air campaign was limited to higher altitudes. Indeed, the 78-day aerial bombardment did not cost the life of a single NATO soldier or airman [Ref. 5]. Furthermore, many air strikes were aborted during the first weeks with the honary aim of minimizing civilian casualties [Ref. 1].

Derived from unclassified NATO sources, one main reason for President Milosevic's withdrawal was the increasing destruction of infrastructure targets. This infrastructure was assessed as a source of income for the Serbian "Nomenclatura." In addition, the decreasing support of Serbia by Russia and the increasing discussion about contingency plans of a NATO ground campaign contributed to the end of Serbia's aggression in Kosovo [Ref. 1]. But to date, the exact cause of the Serbian withdrawal has not yet been determined [Ref. 2].

This thesis analyzes the question: "What might have happened if Serbia had not retreated and NATO had had to conduct a ground forces campaign to achieve its objectives?"

C. OBJECTIVE STATEMENT

This campaign analysis will evaluate the outcome of a NATO ground forces campaign in Kosovo—operations plan (OPLAN) and force structure given—which is launched in order to end ethnic cleansing in Kosovo and force Serbian forces to withdraw from Kosovo. The evaluation will satisfy two measures of effectiveness (MOE): minimizing friendly casualties and successfully ending the campaign as soon as possible.

The created model will also be a starting point for the development of a decision support tool for joint contingency planning in higher HQ.

D. SCOPE AND LIMITATIONS

This campaign analysis is based on the following principles as far as data, level, and jointness are concerned:

The data and information of this campaign analysis are based on unclassified sources.

The level of this campaign analysis is the NATO command level for such a campaign, i.e. Supreme Allied Commander

Europe (SACEUR) level. Thus, this study will limit its resolution to the level of divisions for the Blue Forces (NATO) and to the level of armies for the Red Forces (Serbia); simultaneously, the guerilla warfare element will be taken into consideration.

Although such a campaign would be a joint one, this study will focus on the ground forces. The effectiveness of air forces will be based on the results that the NATO air campaign from March to June 1999 has shown. Thus, this campaign analysis assumes that the ground forces have to achieve the given objectives with very limited air support.

During the NATO air campaign in spring 1999, five basic options for a possible ground campaign were under discussion [Ref. 6]: the "Macedonia Option," the "Montenegro Option," the "Hungary Option," the "Albania Option," and the "Airborne Option." This study will examine the most discussed combination of three of these [Ref. 6], namely the "Macedonia Option," the "Montenegro Option," and the "Albania Option."

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II. A BRIEF HISTORY OF THE BALKAN AREA

A. BEFORE WORLD WAR I

The division of the Roman Empire in the 4th Century AD resulted in the spheres of influence of the East and West Roman Empire. Simultaneously, the differences between the Greek Orthodox and the Roman Catholic Church were born. Today, the border between both religious denominations along the line from the Bay of Cattaro to the River Save still exists [Ref. 7].

After the march through of Huns and Goths, heathen tribes—Croats (Hrvati) and Slovenes in the 7th Century, Serbians (of Slavonic origin) in the 8th Century—settled in most parts of later Yugoslavia. The Montenegrins, of Serbian origin, migrated to the present area in the 14th Century while fleeing from the Turks. The Bulgarians are of mixed origin from Roman Thrace, Slavonia, and Turkey. Albanians (Skipetarians), Macedonians, and Greeks derive their origin from tribes, which settled the Balkans—a Turkish word for mountains—centuries before Christ. These include Albanians who derived from the Pelasgians, Macedonians from the ancient Macedonians, and Greeks from the Hellenes [Ref. 7].

The inhabitants of the Balkans were at all times fanatical followers of their religions. Three main religions are predominant: (1) the Croats and a fraction of the Albanians are Roman Catholic; (2) the Serbians, Montenegrins, Greeks, and Bulgarians are Greek Orthodox; and (3) a fraction of the Croats, Serbians, and Albanians in the present Bosnia area converted to Islam during the Turkish occupation. Those Turks, who have stayed in their former occupied areas, are still Islamic [Ref. 7].

In the 14th Century the Turks started their expansion to the North. On June 27, 1389, the Serbian army was defeated on the Amselfield (Kosovo Polje). The Bulgarians were defeated in 1393, the Hungarians at Nikopolis in 1396, the Greeks in 1446, Serbia in 1459 (which remained occupied until 1815), Albania in 1462 (which remained occupied for 450 years until 1912), Bosnia in 1463, and Herzegovina in 1482 (see Figure 2.1 at the end of this chapter) [Ref 7]. Dalmatia was defeated in 1522, a Hungarian army lost the battle at Mohacs in 1526 (most parts of Hungary remained occupied for 150 years), and Montenegro was defeated in 1528. In 1529 and 1683, the Turks reached Vienna. These and the following centuries were characterized by ever-changing coalitions in a ferocious partisan war of the South Slavs against the Ottoman Empire, which had its largest

extension in the 18th Century (see Figure 2.2 at the end of this chapter) [Ref 7].

The 19th Century brought the gradual withdrawal of the Turks and the liberation of the Balkan nations from the Turkish yoke. The consequences of that century-long occupation have reached into the present. On the one hand, the Croatian and Slovenian cultures are strongly influenced by those of Central Europe because the Turks did not occupy these nations. On the other hand, the Albanians have adopted a lot of Islamic culture during their long occupation [Ref. 7].

In the 19th Century, the Russians and Romanians joined the efforts to repel the Turks from the Balkans. At that time, the Russian-Serbian connection was established. In 1878, the Berlin Congress was conducted to establish an order on the Balkans, but this order failed. After the loss of the common enemy, the Turks, the centuries-old antagonisms returned, and every nation took action against every other. The Macedonia problem became an area of interest for Bulgaria, Greece, and Serbia. Serbia was disappointed that Austria-Hungary was granted Bosnia and Herzegovina. The "Dobruja question" resulted in hostilities between Bulgaria and Romania because Romania got the northern part of Dobruja as compensation for Bessarabia,

which was granted to Russia. Turkish, Greek, and Bulgarian interests clashed in the North Aegean Sea. In October 1912, the Balkan Treaty between Serbia, Bulgaria, Montenegro, and Greece was signed, but no common understanding about a later division of Macedonia could be reached [Ref. 7].

The First Balkan War started on October 8, 1912. Montenegro, Serbia, Bulgaria, and Greece fought against the Ottoman Empire. The Treaty of London (May 30, 1913), which restricted the Ottoman Empire in Europe at Constantinople and the foothills of Thrace, ended that war, but an agreement on the most controversial topics could not be reached. Albanian rebellions against the Turks continued, and Serbia claimed a bigger portion of Macedonia for itself while Bulgaria was still interested in the central portion of Macedonia. All parties rejected a Russian arbitration in the same year [Ref. 7].

The Second Balkan War started on June 30, 1913. Serbia, Montenegro, Romania, and the Ottoman Empire fought against Bulgaria, which was heavily defeated. Due to the Peace Treaty of Bucharest (August 13, 1913), Serbia obtained nearly all of Macedonia and the Sanjak area while Bulgaria obtained a small portion of Macedonia including access to the Aegean Sea; but it had to relinquish South Dobruja to Romania (see Figure 2.3 at the end of this chapter). Thus,

on the eve before World War I, another peace treaty left many Balkan problems once again unsolved [Ref. 9].

B. WORLD WAR I

During World War I, Bulgaria and the Ottoman Empire fought on the side of the Central Powers, Germany and Austria-Hungary, while Greece, Montenegro, Romania, and Serbia joined the Entente Powers—France, Great Britain, and Russia. Albania was the only Balkan nation which remained neutral [Ref. 9].

Regarding the Balkans, two profound changes in the political situation characterized the outcome of World War I. On the one hand, the Austrian-Hungarian Empire was shattered. That resulted in a larger Romania and also in the new countries of Austria, Czechoslovakia, and Hungary. On the other hand, the Kingdom of Serbia & Croatia & Slovenia (Kingdom of SHS) was founded (see Figure 2.4 at the end of this chapter), consisting of Bosnia-Herzegovina, Croatia-Slavonia, Macedonia, Montenegro, Serbia, and Slovenia [Ref. 8].

C. BETWEEN THE WORLD WARS

When the concept of forming a state of the South Slavs on the Balkans first appeared in 1916, Croatia and Serbia struggled over the dominating role in this multi-racial

state. Because the Serbians were the majority in this new country and Croatia fought with the defeated Central Powers in World War I, many of Belgrade's decisions resulted in Croatian resistance. Furthermore, Croatian's banking, industry, and wholesaling fell into Serbian hands. Changes in the constitution favoring the Serbians definitely increased the tensions. In 1928, some Croatian members of parliament, including their leader Stjepan Radic, were assassinated in the parliament building in Belgrade [Ref. 7].

In 1929, the Kingdom of SHS was renamed as the Kingdom of Yugoslavia, which included a further reorganization of the administration in favor of the Serbians. The tensions increased, and in 1932 the Ustasa, a terror organization fighting for an independent Croatia, conducted a Croatian rebellion. The rebellion was bloodily repressed [Ref. 7].

During a state visit in France in 1934, the Yugoslavian king was assassinated by a Bulgarian terrorist with close connections to the Ustasa. On January 15, 1939, the Croatian members of parliament declared Croatia's independence from Belgrade [Ref. 7].

On April 7, 1939, Albania was occupied by Italy, which soon after built up strong forces in that region. And,

contrary to its public statements, Italy's territorial interests soon began to focus on Greece as well [Ref. 7].

On the eve of World War II, moderate Croatian and Serbian politicians tried to find a balance in the areas of political power sharing and economical equality, but the internal unsteadiness of Yugoslavia remained. From 1918 until 1941, Yugoslavia had 39 governments, averaging a new one every seven months. Furthermore, the Communist Party of Yugoslavia had supported all the separatist efforts of the Croatian Ustasa, the Macedonians, the Albanians, and the Montenegrins, in order to benefit from these internal tensions [Ref. 7].

D. WORLD WAR II

After Italy had declared war on England and France in June 1940, it attacked Greece out of Albania on October 28, 1940. But the attack failed, and Italy was repelled into central Albania until November 1940. In December 1940, Italy begged for German aid on the Balkans [Ref. 7].

In early 1941, Bulgaria, Hungary, and Romania joined the Axis Powers. Yugoslavia was then virtually surrounded by the Axis Powers and their allies. On March 25, 1941, Yugoslavia joined that Pact as well. But, on March 26 and 27, 1941, a coup d'état was conducted and the new leaders

canceled the two-day old agreement. Yugoslavia started its mobilization a few days later and signed a treaty with the Soviet Union [Ref. 7].

On April 6, 1941, Germany attacked Yugoslavia from Bulgaria, Hungary, and Romania, joined by a few Hungarian and Italian units [Ref. 10]. A little more than 30 divisions, together with heavy air raids on Belgrade and the early defeat of the Yugoslavian Air Force ended the campaign in less than two weeks [Ref. 10], in which Germany lost less than 200 men [Ref. 11]. With the armistice of April 17, 1941, Yugoslavia ceased to exist. Germany, Italy, Hungary, and Bulgaria annexed parts of the country. The remaining territory was divided into the three states Croatia, Montenegro, and Serbia, which were in varying degrees subordinate to the Axis Powers [Ref. 8].

The Independent State of Croatia was the largest among these wartime states, headed by the Ustasa. The two other wartime states were Serbia, under a civil administration, and Montenegro, which was occupied by the Italians [Ref. 8].

Before the end of 1941, a large portion of former Yugoslav territory became a field for guerilla operations. The two main groups conducting this partisan warfare against the German occupying forces were the royal Serbian Cetniks

and the communist Partisans under Josip Broz Tito (1892-1980) [Ref. 8].

Croatian, Serbian, Muslim and Bosnian, Russian and Bulgarian units, and also ethnic Germans from the Hungarian Banat area [Ref. 12], fought on the German side. In 1944, the Cetniks disbanded its units; some of them joined Germany while others continued fighting under Tito [Ref. 12].

From 1942 until the beginning of the German withdrawal in September 1944, the partisan war increased; a pacification of the occupied area never happened. By June 1943, Germany and its allies had increased the number of its divisions in theater up to 12. By December 1943, this number increased to 18 [Ref. 12]. The guerilla war reached its peak in 1944, when Germany and its allies had more than 20 divisions in theater [Ref. 12]. In Yugoslavia, Germany was opposed by 50,000 to 60,000 Partisans and 12,000 to 15,000 Cetniks (mobile units only); in Albania, by a total estimated to be as many as 20,000, with the strongest group that of the Communist leader, Enver Hoxha [Ref. 7]. On the basis of incomplete casualty figures, it can is said with some degree of accuracy that one out of seven soldiers in German uniform became a casualty by the close of operations [Ref. 7]. It is estimated that the partisan warfare in the Balkans from 1941 to 1945 did cost all together on both

sides about 1,750,000 million lifes [Ref. 7]. Furthermore, approximately 820,000 homes and 90% of the railway infrastructure were destroyed [Ref. 7].

World War II in the Balkans was a war of everyone against everyone: Serbians and Croatians fought against Germans; Italians and Croatians fought against Serbians; Germans and Italians allied with Croatians and Serbians battled Tito's Partisans; also Albanians fought against Tito; supporting the Germans, Mihailovic-Cetniks engaged the Partisans; veterans of the Russian Czar-army fought against Tito; Macedonians battled Slovenians; Christians fought Mohammedans; several Greek units fought against each other; Cossacks and Waffen-SS-units clashed with Partisans; and finally English troops fought against Greeks [Ref. 7].

E. AFTER WORLD WAR II

By the end of World War II, Tito's Partisans had become the dominant force in the Yugoslavian area; eventually, the Allies recognized them [Ref. 8]. After many massacres during the war and many post-war counter-massacres, Tito established Yugoslavia as a federal Republic in November 1945. Once again, this compulsory calming ("iron clamp")was based on Serbian pre-dominance, although Tito himself was of

Croatian origin and had fought during World War I in the Austrian-Hungarian Army [Ref. 13].

The new country's boundaries were defined according to the pre-1941 frontiers with Hungary, Romania, Bulgaria, and Albania. Since Yugoslavia was a partner of the victorious allies, some territories were added. The pre-war internal Serbia-dominated composition was succeeded by a federation of six equal republics and two autonomous regions (see Figure 2.5 at the end of this chapter). While Slovenia, Croatia (including Slavonia), Bosnia-Herzegovina and Montenegro were approximately restored according to their Austrian-Hungarian boundaries, Serbia changed substantially. The former southern part of Serbia became the Republic of Macedonia. In the southern region of Serbia the autonomous region Kosovo, primarily inhabited by Albanians, came into being while in Serbia's northern part another autonomous region—the Vojvodina—was established [Ref. 8].

Tito's decision to grant the Kosovo and the Vojvodina a wider autonomy in the new constitution of 1974 was vehemently criticized by the Serbians. After the death of Tito in 1980, the mythical nationalism, together with religious fanaticism and centuries-old hatred arose again. A rebellion by Kosovar-Albanians for the creation of a republic within Yugoslavia was brutally suppressed in 1981.

Then, in March 1989, Serbian President Milosevic canceled Kosovo's autonomy [Ref. 13]. This caused tensions with the other republics, which feared the increasing Serbian power within the Yugoslav federation. The declaration of independence by Slovenia, Croatia, and Macedonia in 1991 and Bosnia-Herzegovina in 1992—leaving the republics of Serbia and Montenegro as the remainder of Yugoslavia (see Figure 2.6 at the end of this chapter)—caused a murderous civil war, which NATO air strikes ended in 1994 [Ref. 8].

In 1996, the tensions in Kosovo between Serbians and Kosovar-Albanians increased again and eventually led to another NATO air campaign in the spring of 1999 [Ref. 13].

F. CONCLUSION

For centuries the Balkan nations have endured continuous bloodshed. These nations have suffered seven hundred years of political and civil oppression, resulting in countless wars with alternating coalitions. The extermination of the population of entire areas, the cruel torture of prisoners, and the systematic massacring of women and children has become part of the Balkan culture. Historically, the mutual violence could only be suppressed when strong political leadership could form a united organization. The hatred, however, was not eliminated—only

left dormant. As soon as the "iron clamp" ceased to exist, the violence among the Balkan nations erupted again.

Figure 2.1. *The expansion of the Ottoman Empire on the Balkans in the 14th - 15th Century established its long-lasting domination (after [Ref. 8]).*

Figure 2.2. *The Balkan Nations were still under the rule of the Ottoman Empire in the 18th Century (after [Ref. 8]).*

Figure 2.3. *The withdrawal of the Ottoman Empire from the Balkan Peninsula by the beginning of the 20th Century resulted in the First and Second Balkan War in 1912-1913 (after [Ref. 8]).*

Figure 2.4. *World War I resulted in the foundation of several countries in the Balkans 1918-1923 (after [Ref. 8]).*

Figure 2.5. *As a result of World War II, the boundaries of every country on the Balkans (except Albania) changed from what they had been during the inter-war years (after [Ref. 8]).*

Figure 2.6. *In 1992, the recent tensions on the Balkans resulted in the break-up of Yugoslavia into Slovenia, Croatia, Bosnia-Herzegovina, Serbia & Montenegro, and Macedonia (after [Ref. 8]).*

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III. THE MODEL

A. CHOICE OF TOOLS

The decision about the appropiate model for the operational context of this campaign analysis [Ref. 14 and 15] was driven by the desired outcome, the clarity of the documentation of available models, and the availability of unclassified data for these models. The author has chosen a situational force scoring methodology, developed by RAND.

The initial idea of using the General Campaign Analysis Model (GCAM™) to implement the chosen methodology could not be conveniently translated into action. The overall model of this campaign analysis is implemented by using Excel spreadsheets. As a by-product of the attempt using GCAM™, a small model is used to give a rough time line estimation for the deployment of the Blue Forces while simultaneously partisan warfare against supply routes is taken under consideration.

B. SITUATIONAL FORCE SCORING METHODOLOGY

This paper's aggregated combat model uses the situational force scoring (SFS) methodology, introduced by RAND, to compute force ratio, attrition, and movement as the result of combat [see Ref. 16]. The SFS methodology is a

force-on-force methodology which adjusts scores dynamically by considering the effects of the type of terrain, the type of battle, and the combined arms imbalances—or shortages. Once all these factors are analyzed, the actual force scores of both sides are obtained.

The SFS methodology describes results of engagements among aggregated combat units. Individual combatants are not represented in these units, rather the contribution of the individuals are averaged together over weapon system classes within the unit. This firepower score approach measures the combat power of a unit by summing the combat power values of each weapon system (number of available assets times value of asset) in that unit. These values are then modified by factors, which represent the influence of terrain, the type of battle, and other such variables. The force ratio is then calculated as the attacker's combat power divided by the defender's combat power. This formula gives a measure of relative combat power in the battle. Finally, the force ratio, combined with influencial factors like the terrain and the type of combat, is used to determine attrition and movement of the forward edge of the battle area (FEBA) [see Ref. 17].

The SFS methodology, developed by RAND, accounts for situation-dependent combined arms effects in aggregate

combat models, which is described in detail in the RAND Note N-3423-NA [see Ref. 16]. This methodology is chosen as a base for this campaign analysis, because, especially in the given scenario, the value of a unit's component weapon is a function of the special combat situation in that theater. This special combat situation is determined by the type of terrain, by the type of battle, and by the possible shortages in the weapon mix. All of these factors are well reflected in this SFS methodology.

Required data were taken from the RAND Note N-3423-NA [see Ref. 16] and updated or completed by data found on RAND's web site [see Ref. 18]. In addition, the author used military judgment to define further missing data.

The SFS methodology is a 20-step calculation process, divided into four stages, as shown in Figure 3.1.

The four stages are:

I Varying the strength of each category of weapon as a function of terrain and type of engagement (steps 1 - 7).

II Modifying category multipliers to account for shortages in the combined arms mix (steps 8 - 9).

III Calculating combat outcomes, including both sides' losses and FEBA movement (steps 10 - 13).

IV Calculating casualty distributions (losses of

weapon systems by type of system) across each category of weapon (steps 14 - 20).

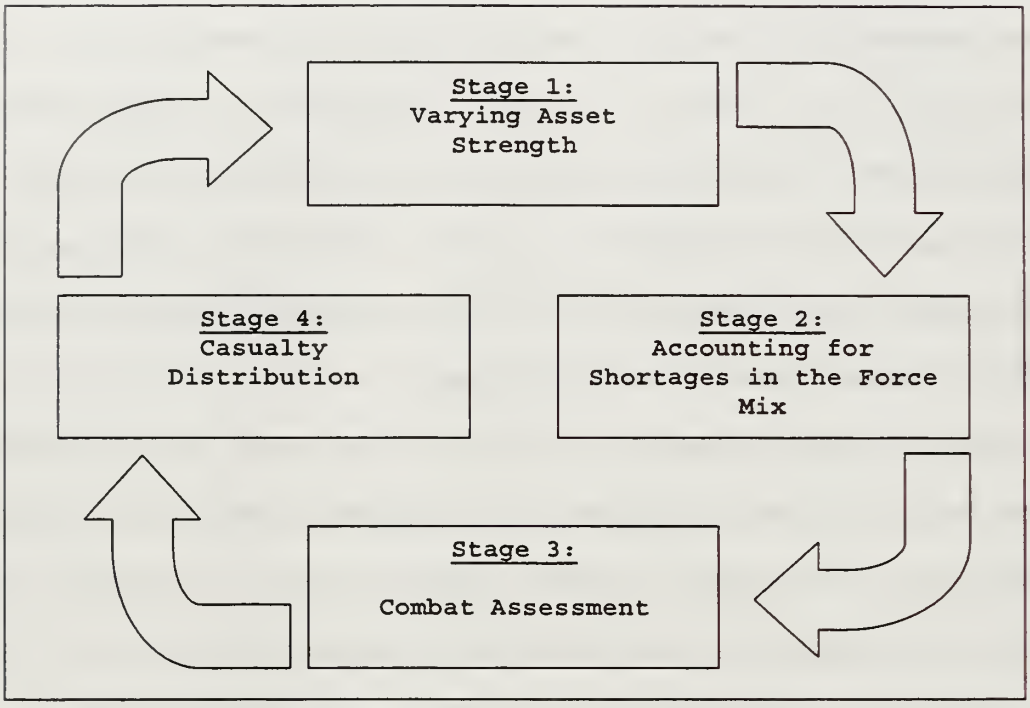

Figure 3.1. *The SFS Methodology is a calculation cycle consisting of four stages for every time step.*

To give the reader an overview regarding the concept behind the calculation for each step, the steps are briefly explained as follows (for a more detailed description see [Ref. 16]).

1. Number of Assets in the Forces

The calculations start with the number of assets in both forces. For the given scenario, the types of assets are:

- Tanks
- ARVs (armored reconnaissance vehicles) and IFVs (infantry fighting vehicles)
- APCs (armored personnel carriers without anti-tank capability)
- Anti-tank weapons
- Infantry assets (mortars under 100 mm, small arms); note that the number of troops (i.e. fighting troops) is represented by the number of small arms
- Gun artillery (self-propelled artillery, towed artillery, and mortars 100 mm and above)
- Rocket artillery, i.e. multiple launch rocket systems (MLRS)
- Attack helicopters
- Air defense weapons.

These weapon categories are combined into the force ratio representing the basic ground combat assessment. To avoid divisions by zero, asset numbers that are equal to zero are represented by 0.00001 in the spreadsheet.

2. Asset Score

Basically, each type of asset is given a value relative to the other types of assets in that category (e.g. different values for different tanks). Since the equipment of a NATO division is standardized, the scores for types of assets equal the score of the respective weapon category. The varied weapon mix on the Serbian side is taken under consideration by averaging the scores of asset types into weapon category scores. In order to combine all weapon categories into a total force score, a category weight is applied to each weapon category (e.g. tanks).

3. Raw Category Strength Points

The number of assets in each weapon category of step 1 is multiplied by the corresponding value of this category in step 2. The total raw strength points are obtained by summing the strength points in each category.

4. Force Multipliers

Force multipliers are applied to take significant qualitative factors influencing combat effectiveness into consideration. Level of training, cohesiveness, and nationality are among such considerations. These force multipliers enable the author to represent the peculiarities of the given scenario, e.g. partisan warfare. The base case does have equal values for both sides.

5. Base Category Strength Points

To obtain the base strength points for each weapon category, the results of step 3 and step 4 are multiplied for each category. The total strength equals the sum over the strength points of all weapon categories.

6. Situational Category Multipliers

At this step, the influence of type of battle and type of terrain are taken into consideration. RAND sources [Ref. 16 and 18] provide look-up tables, one for the attacker and one for the defender, where the weapon category multipliers are listed. These situational category multipliers depend on five types of terrain (open, mixed, rough, urban, and mountainous) and on nine types of battle (breakthrough, withdrawal, delay, hasty defense, deliberate defense, prepared defense, fortified defense, stalemate, and meeting engagement). The peculiarities of the Balkan theater are represented in this step by chosing values for "prepared defense" and "mountainous terrain."

7. Situational Category Strength

The situational category strength is calculated by multiplying the results of step 5 and step 6 in each weapon category. Obtained is the strength contributed by each weapon category as a function of type of terrain and type of battle. This completes the first stage of the SFS

methodology, followed by the calculation of combined arms shortages.

8. Shortage Category Multipliers

This step determines whether or not a shortage exists in the weapon categories as a function of the combat situation. Therefore, the multiplier associated with each shortage, as a function of the battle situation, is determined. These factors, representing the shortage category multipliers, are obtained from look-up tables in the RAND Note [Ref. 16 and 18]. This step might take into consideration the fact that the Serbian forces lack modern mechanized equipment and over-emphasize infantry elements, which are far more adapted to warfare in mountainous terrain. NATO forces, on the contrary, usually balance the lack of infantry with high-tech equipment.

9. Final Category Strength

The final category strength is obtained by multiplying the results of step 7 and step 8 in each weapon category. This concludes the second stage of the SFS methodology. The following steps will proceed with combat assessment.

10. Force Strength

The total force strength for each side is given now by the sum of the values of step 9. This sum will be used in

the combat assessment process to determine losses on both sides.

11. Force Ratio

The force ratio equals the ratio of the attacking force strength to the defending force strength, obtained at step 10. This modified force ratio (MFR) together with the type of battle will determine the loss-rates for both sides and the FEBA movement rate. Due to the overall operational situation, the factor of "surprise" is not regarded here.

12. Loss Rate, Exchange Rate, and FEBA Movement Rate

At first, the level of intensity of the attack is determined (low, medium, and high); the base case starts at the medium level. These attack-intensity parameter multipliers are obtained from look-up tables of the RAND Note [Ref. 16 and 18]. Then, the defender loss-rate (DLR), the exchange rate (ER), the attacker loss-rate (ALR), and the FEBA movement rate (FMR), and the FEBA location—accumulative sum of the FMR—are calculated. For details of these calculations see [Ref. 16]; for now it is sufficient to state that the force ratio and type of engagement determine the DLR and ER, and through these the FMR. The DLR is the fraction of the defending force lost in this assessment cycle; the ALR is similarly defined. The ER is

the ratio of attacking strength lost for every point of defending strength lost.

13. Final Category Strength Lost by Each Side

The loss rates of step 12 are multiplied by the total of step 9. This result will be used to determine total losses by category in the steps of the fourth stage of the SFS methodology.

14. Final Category Strength

The calculations of the casualty distribution start with the results of step 9, the final category strength points. These strength points will be used to determine the fraction of strength contributed by each weapon category.

15. Category Loss Multiplier

Different types of weapons are destroyed at different rates depending on the situation and the opponent's weapon mix. A look-up table [see Ref. 16 and 18] is used to determine the casualty distribution for each type of battle, which for this operational context is defined as assault. These loss-multipliers are obtained for each weapon category based on the fact that on NATO's side armor is the primary assault weapon while it is infantry on the Serbian side.

16. Shortage Category Multipliers

Shortage multipliers represent the casualty distribution effect of shortages on the casualty pattern.

The shortage factors are obtained by duplicating step 8 as step 16.

17. Relative Category Losses

The final category strengths of step 14 are multiplied by the category loss-multipliers of step 15. The result is divided by the shortage category multipliers of step 16. The resulting values in each weapon category represent the relative loss-rates of each weapon category.

18. Normalized Category Strength Lost

The normalized category strength lost for each weapon category is obtained by multiplying the results of step 13 by those of step 17. The results are then divided by the sum of the values of step 17.

19. Fractional Loss

The fraction of final strength lost in each weapon category is obtained by dividing the results of step 18 by those of step 14.

20. Number of Assets Lost by Each Category

Finally, the values of step 19 are multiplied with the initial number of assets of this assessment cycle given in step 1. The results are the number of assets lost by each weapon category in this assessment cycle which is defined for this campaign analysis as one day. The final strength

of the cycle is then obtained by subtracting step 20 from step 1, which are the starting numbers for the next cycle.

C. GENERAL CAMPAIGN ANALYSIS MODEL (GCAM™)

The General Campaign Analysis Model (GCAM™) was developed by *Systems Planning & Analysis, Inc.* for *N-81* for conducting campaign analyses for the Department of Defense (DOD). It provides good visualization of the simulation.

GCAM™, developed by *Systems Planning and Analysis, Inc.*, consists of three major components. They are Conditional Object Oriented Meta-Language (COOML™), ObjectManager™, and General Analytic Modeling Environment (GAME™). Models and simulations are written in a high level modeling language, COOML™, which allows building objects and conditional instructions for the simulations. ObjectManager™ serves as the text editor for COOML™. It is the working environment that runs scenarios by creating sets of instructions in COOML™. A C++ Monte-Carlo simulation engine, GAME™, the GCAM™ simulation engine, evaluates COOML™ instructions [Ref. 19].

A one-week introduction course at the headquarters of *Systems Planning & Analysis, Inc.* at Alexandria, VA, enables the GCAM™ user to start working with the system.

IV. SCENARIO, OPERATIONS PLAN, AND FORCES

A. SCENARIO

Four of the five options mentioned in Chapter I—the "Albania Option," the "Hungary Option," the "Macedonia Option," and the "Montenegro Option,"—which were under discussion during the NATO air campaign in spring 1999 [Ref. 6], had one fact in common: they planned an invasion into Serbia, including Kosovo, from a single neighboring country of Serbia. The fifth option, an airborne operation, was seen as a first phase before launching one of the land options [Ref. 6].

1. An Earlier Study

Preceding this analysis, the author participated in a study of a single-entry invasion ("Hungary Option") of Serbia [Ref. 20]. In order to determine a benchmark for the heterogeneous-force serial acquisition model, the authors of that study first employed a single-sector force ratio model with Dupuy's approach [Ref. 21 and 22] for equipment losses. The model itself was an aggregated combat model, which utilized heterogeneous-force kill rates and serial acquisition; it was built with a Visual Basic macro that ran behind a Microsoft Excel spreadsheet [Ref. 20].

Both the Dupuy single-sector force ratio model and the heterogeneous-force serial acquisition model provided similar estimates for the length of time and number of losses to complete the first campaign phase (seizing rivers Sava and Danube beside Belgrade) of an Allied attack into Serbia out of Hungary. The two attacking NATO divisions reached the objective for the examined phase in less than a week, but the number of NATO's losses was relatively high (for details see [Ref. 20]).

The overall conclusion was the recommendation for a different strategic approach: relating to the results of the actions in World War II, NATO would be recommended to open up a second and even third front by attacking out of other Serbia's neighboring countries. That might force Serbia to split up its forces and thus reduce friendly casualties.

2. Study of the German Invasion of Yugoslavia in 1941

In World II, on 6 April 1941, Germany launched its attack into Yugoslavia with 33 divisions from Bulgarian, Hungarian, and Romanian territory (see Figure 4.1 next page.) Supported by heavy air raids on Belgrade, this was a new display of "Blitzkrieg" [Ref. 10]. At a very early stage of that campaign, the Yugoslavian Air Force was defeated—before it could come to the nation's defense [Ref. 11].

The German plan called for an incursion from Bulgaria by the 12th Army, which would aim southward to prevent possible Greek assistance to the Yugoslavs. Two days later, the 1st Panzer Group would lead north toward Nis and Belgrade, where it would be joined by the 2nd Army and other units (from Italy, Hungary, and Germany—attacking from the North.)

Figure 4.1. *In April 1941, Yugoslavia was defeated by a German attack in less than two weeks (after [Ref. 10]).*

The plan worked smoothly, and there was little resistance to any of these attacks, launched between April 6 and 17. On April 17, an armistice was signed [Ref. 11].

Germany lost only 151 men in the entire 11-day campaign due to its superior equipment and the strategic approach [Ref. 11]. Additionally, internal dissension among the various Yugoslavian states aided Germany. Another factor in Germany's favor was the defender's use of an ineffectual cordon deployment that was no match for the strength and numbers engaged against them. Finally, Germany's air superiority, including the early defeat of the Yugoslavian Air Force, completed the case [Ref. 11].

3. The Scenario

The scenario of this campaign analysis is based on the above mentioned results of the preceding study, the evaluation of military history, and the fact that in Spring 1999 the most discussed ground forces campaign scenario (in open sources) was that of a combination of at least two options [Ref. 6]. Thus, the scenario chosen for this thesis reflects the combination of the "Macedonia Option," the "Montenegro Option," and the "Albania Option;" i.e., the invasion into Kosovo and southern Serbia out of the Former Yugoslav Republic of Macedonia (F.Y.R.O.M., in the following called Macedonia), Montenegro, and Albania.

The chosen scenario does include a principle build-up phase of NATO forces in Albania, Macedonia, and Montenegro for two reasons. First, unlike the build-up phase for "Desert Shield" and "Desert Storm" (Gulf War 1990-1991) the training of the forces scheduled to go into action will be conducted in the respected home countries due to political and organizational reasons [Ref. 23]. The deployment then will serve a pre-determined political escalation which enhances the deterrence by creating increasing political pressure on Serbia. Secondly, the following political assumptions assume that this phase will already have some combat elements—represented by partisan actions of Serbian elements in Montenegro.

Albania and Macedonia provided their territory as a starting base for the KFOR (Kosovo Force) operation, which followed immediately after NATO's air strikes in June 1999 [Ref. 24]. Thus, a partisan warfare threat on their territories is not assumed.

NATO-member Greece, though in opposition to the NATO engagement in that region due to an old conflict with Macedonia, has been supporting the KFOR as well [Ref. 24]. Thus, no actions against NATO troops on Greek territory is included.

Since the break-up of the former Yugoslavia in 1992, the Republic of Montenegro has been under the rule of the Republic of Serbia in the remainder of Yugoslavia. Due to the Serbian pre-dominance, tensions have steadily increased. In preparation for the defense against NATO's air campaign, many Montenegrin reservists did not follow their conscription into the Serbian forces [Ref. 25]. Additionally, the number of armed incidents between Montenegrin police forces and regular Serbian forces had significantly increased since 1998 [Ref. 26]. Repeatedly, NATO had to calm the Montenegrin government to prevent a public plebiscite about a secession from Serbia [Ref. 25]. Recently, rumors have occurred that a new constitution has been prepared in Belgrade, because the present constitution theoretically allows Montenegro to secede from Serbia after a positive public plebiscite [Ref. 27]. Many analysts assume that Montenegro would secede before a NATO land campaign, so that they would not end up on the defeated side and, furthermore, so that they could fulfill their independence aspirations [Ref. 25].

Thus, the author has added the "Montenegro Option" to the "Albania Option" and the "Macedonia Option."

B. THE TERRAIN

In general, the southern part of former Yugoslavia is a mountainous region with a varied appearance. Densely wooded, undulating, and mountainous terrain in the North changes to treeless, arid, and to karst developed chalky plateaus in the South. Some massifs even gain alpine elevations [Ref. 28]. The topography is as follows: arable land 36%, woodlands 29%, pasture land 21%, and other 14% [Ref. 28].

In 1991, Kosovo had a population of 1.96 million people [Ref. 28]. Its 10,887 km^2 made up 10.7% of the territory of the former Yugoslavia [Ref. 28].

The northwestern area of Kosovo is characterized by the two wide basins of Kosovo Polje (500 km^2) and Metohija (600 km^2) on 500 m (NN) and the to karst developed mountain range on 500 - 1400 m (NN) in between (see Figure 4.2 at the end of this chapter). Only three other basins occupy the small open terrain: in the northeast, Little Kosovo (80 km^2); in the east, the Gnjilane Basin (400 km^2); and in the center, the Drenica Basin (1,200 km^2) [Ref. 29]. The Kosovo area is surrounded by chalky massifs which reach an elevation of more than 2,500 m (NN): Kopaonik in the North, Crna Gora in the Southeast, Sar Planina in the South, and the Albanian Alps in the West [Ref. 28]. These ridges of mountains are

punctuated only by a very limited number of passes and rivers, through which access into Kosovo on roads is possible (see Figure 4.2 at the end of this chapter).

Kosovo has some 1,500 settlements. Fifty percent of the population lives in small settlements (up to 10,000 people). The larger cities are Pristina (above 100,000), Prizren (70,000), Pec (60,000), Kosovska Mitrovica (58,000), Djakovica (46,000), and Gnjilane (40,000) [Ref. 29].

The road network in the southern part of former Yugoslavia is only moderately developed. The main roads are asphalt roads, while many minor and mountain roads are gravel roads only. Due to snowdrifts, many mountain passes and high-altitude roads are closed to traffic during winter time. The two main southward routes Belgrade-Nis-Skopje(Macedonia)-Thessaloniki(Greece) and Belgrade-Podgorica(Montenegro)-Kotor(Montenegro) do not lead through Kosovo (see Figure 4.2 at the end of this chapter).

The rail network in the same area is also not well developed. In 1997, only the two main railways southwards, Belgrade-Nis-Skopje(Macedonia)-Thessaloniki(Greece) and Belgrade-Priboj-Podgorica(Montenegro)-Bar(Montenegro), were electrified [Ref. 28]. But, all minor railways have been switched over to the European rail standard gauge, like the main railways. The terrain limits the capacities of the

routes (see Figure 4.2 at the end of this chapter). For example, the main railway Belgrade-Bar(Montenegro) is a 476-km single-track railway with 234 bridges; 24% (114 km) of its length consists of tunnels [Ref. 28].

C. OPERATIONS PLAN

The chosen overall concept of operations (CONOPS) for a NATO campaign on the Balkans, which includes ground forces, is divided into four phases [Ref. 6]: a deployment phase (deployment of NATO troops in assembly areas close to the ports of embarkation), a forward deployment phase (deployment of these troops close to Serbia's borders), an air campaign (air strikes in preparation of the land campaign), and a ground campaign (attack of NATO ground forces into Kosovo).

An air campaign in preparation for a ground forces campaign is limited to tactical targets in southern Serbia and Kosovo. Destroyed infrastructure would slow advancing NATO forces and, thus, increase casualties.

The CONOPS includes the engagement of four divisions. Based on the availability of data and the efficiency of the operational approach, the author has chosen one division from each, Germany (GE), France (FR), the United Kingdom (UK), and the United States of America (US). The basic idea

of the operations plan (OPLAN) for each division is as follows (see Figure 4.3 at the end of this chapter).

The US division is assigned to Montenegro. From the assembly area (AA) around the port of embarkation (POE) Bar (Montenegro), the forward assembly area (FAA) in eastern Montenegro is reached evenly by railway and road. For the ground campaign, the US division is tasked to seize the northwest area of Kosovo (80 km advance distance) and simultaneously to be prepared to secure NATO's left flank against possible Serbian attacks from the north.

The POE for the FR division is Durres (Albania). From that AA the FAA in northeast Albania is reached by railway, but mostly by road. Within the attack framework, the FR division is to seize the southwest area of Kosovo (30 km advance distance).

Due to the large capacity of the NATO harbor Thessaloniki (Greece), both the UK division and the GE division have it as a common POE. The UK division's AA is located west of this POE from where the FAA in northwest Macedonia is reached by railway. The UK division is then tasked to attack north and seize the southeast area of Kosovo (50 km advance distance).

The GE division has its AA north of the Greek POE. The FAA in northeast Macedonia is reached mostly by railway.

For the ground campaign, the GE division is tasked to seize the northeast area of Kosovo (80 km advance distance) while simultaneously being prepared to secure NATO's right flank against possible Serbian attacks from the north and northeast.

In compliance with NATO's concept of pre-determined escalation [Ref. 30], every phase of the CONOPS is intended to increase the political and military pressure on Serbia in order to maintain the possibility of reaching the overall goal without the use of military force. In analogy to the actions in Spring 1999, the air campaign and ground forces campaign will be launched only with the consent of all 19 NATO members. For this study, that consent is assumed, as well as the fact that the deployed NATO forces are fully equipped and adequately trained—like for "Desert Storm" (Gulf War 1990-1991) [Ref. 23]—before the attack is launched.

D. BLUE FORCES (NATO)

This campaign analysis is conducted on the same NATO command level as the actions in spring 1999: the Supreme Allied Commander Europe (SACEUR) level. Thus, the resolution for the Blue Forces (NATO) is the level of

divisions and that for the Orange Forces (Serbia) is the army level.

The maneuver element provided by France is the 2nd (FR) Armored Division, which is divided into two armored regiments, three mechanized infantry regiments, a reconnaissance squadron, an armored anti-tank squadron, and a self-propelled artillery regiment [Ref. 31 and 32]. For details see Annex A.

Germany goes into theater with its 7th (GE) Armored Division, with one armored brigade, two mechanized infantry brigades, a self-propelled artillery regiment, an army air defense regiment, and a reconnaissance battalion as its assets [Ref. 33 and 34]. For details see Annex A.

The United Kingdom provides the 1st (UK) Armored Division, with three armored brigades, a division artillery group (consisting of artillery and air defense assets), an armored reconnaissance regiment, and an aviation regiment [Ref. 35 and 36]. For details see Annex A.

The United States of America provide their 1st (US) Infantry Division (Mech), which consists of three mechanized brigades, one aviation brigade, a division artillery element, and an air defense battalion [Ref. 37 and 38]. For details see Annex A.

E. ORANGE FORCES (SERBIA)

The Serbian Army consists of three armies with eight army corps, three task forces, and several air defense and artillery units. Additionally, a Special Forces Corps (only in peace time under army command) and a corps-sized Belgrade Defense HQ is available (see ANNEX B)[Ref. 39].

The inventory data for Serbia's equipment (see ANNEX B) show that only a small fraction of forces consist of modern equipment [Ref. 40, 41, and 42]. This will be taken under consideration with the respective weapon scores in the model; the old T-34 tanks in Serbian depots are not included (see Annex B) because the probability of its engagement is quite low due to the lack of trained personnel and the lack of spare parts.

The terrain with its mountainous, rugged, and channeling character allows ambushing and in general close-range fighting. On these close ranges, old weapons are effective and therefore a threat even to modern mechanized weapon systems, especially, if employed in an enemy's flank or back. Thus, the old recoilless rifles are included (see Annex B).

There is an enormous difference in the number of peacetime and wartime troops in the Serbian forces [Ref. 39]. On NATO's side, only fighting troops are counted. The

respective number on the Serbian side is high because it is realistic and prudent to assume that Serbia will use the NATO build-up and deployment phases for a mobilization as extensively as possible. Furthermore, the security, paramilitary, and police forces, which are not part of the regular army forces [Ref. 39]—but have almost the same strength as the entire regular Army—are reflected in those high numbers. The actual numbers of fighting troops is derived by using the relation of 1:16 for fighting troops:strength (i.e. for every fighting soldiers, 16 soldiers are needed for combat support, logistics etc.); this relation is with up to 1:20 even higher for NATO forces [Ref. 15].

The three Serbian army corps are located as follows [Ref. 39]: 1st (SER) Army is located in the area north of Sava-Belgrade-Danube, 2nd (SER) Army in southwest Serbia and Montenegro, and the 3rd (SER) Army in southeast Serbia. It is assumed that during NATO's preparation phases the 2nd (SER) Army will leave Montenegro—leaving some elements behind which might conduct ambushing on NATO supply routes—and, together with the 3rd (SER) Army, will prepare for defense in mountainous Kosovo and southern Serbia. A NATO surprise attack can be excluded since the requested time and the extent of the preparations do not allow a deception of

the Orange Forces about the strategic approach. The 1st (SER) Army is expected to be available as a strategic reserve in the area around Belgrade while simultaneously providing a minimal protection force at Serbia's border to Croatia.

F. OPPOSING FORCES

Based on the preceding operational facts, the approach for the opposing ground forces is as follows: the US and the FR division will have to cope with the 2nd (SER) Army in western Kosovo. For the model it is assumed that both the US and the FR division will have to deal each with half of the strength of the 2nd (SER) Army. The GE and the UK division will have to deal with the 3rd (SER) Army in eastern Kosovo. In this area, it is also assumed that both the GE and the UK division will face half of the 3rd (SER) Army asset inventory number.

Although the US division and the GE division have to prepare contigency plans for securing NATO's northern flank, it is not assumed that the 1st (SER) Army will be employed southward. Its engagement against NATO forces is excluded as long as NATO does not proceed north for Belgrade, the core area for the present regime.

The asset numbers for the opposing forces, as well as the values for weapon category scores, force multipliers, situational multipliers, and shortage multipliers are listed in Annex C.

Figure 4.2. *Traffic development in southern Serbia, Kosovo, and Montenegro is very limited due to the extensively dissected terrain (after [Ref. 28]).*

Figure 4.3. *The NATO concept of operations is based on four divisions, one each provided by France, Germany, the United Kingdom, and the United States of America.*

V. RESULTS, ANALYSIS, AND CONCLUSIONS

A. THE GCAM™ MODEL

The GCAM™ simulation was used for analyzing the deployment phase and the forward deployment phase. It shows that the force build-up of the four NATO divisions in the assembly areas (AA) around the ports of embarkation (POE) can be completed within three weeks. This does not include a preceding preparation of the harbors with its unloading facilities. Furthermore, the forward deployment from the AA into forward assembly areas (FAA) close to Kosovo's borders is possible within one week. This again does not include any preparation of the infrastructure. Since the four divisions conduct this forward deployment with different transport means, a coordination time frame of at least five days would be necessary to enable NATO to launch its ground attack into Kosovo coordinatedly with all available forces as soon as the FAA are reached.

Due to the assumed political and military situation, the simulation underlines that the US division has to be prepared to defend its deployment and supply routes against ambush actions. The recommendation for the decision maker would be to deploy security forces along these routes which are not part of the attacking units.

Although this simulation includes only the prelude phase for the ground forces campaign (no real firefights between larger units yet), the coding was extensive (see Annex D). It has turned out that the use of GCAM™ for an initial military decision—usually as a reaction to an uprising crisis under time and political pressure—is too time consuming. GCAM™ is better used when fundamental decisions have been made and more detailed answers are needed for further specific planning purposes.

B. THE RAND SFS MODEL

The results of this campaign analysis' base case are discouraging. No NATO division comes close to its objective because the inventory number of infantry assets—which include troops—fade down to zero much earlier. This is not acceptable, even under the rule of thumb that among casualties the relation between the dead and wounded is 1:3 [Ref. 15]. The GE division reaches a stalemate (i.e. has to change into hasty defense) after 24 km on day 5, the UK division after 16 km on day 4, the US division after 33 km on day 5, and the FR division after 8 km on day 3 (see Figure 5.1 below).

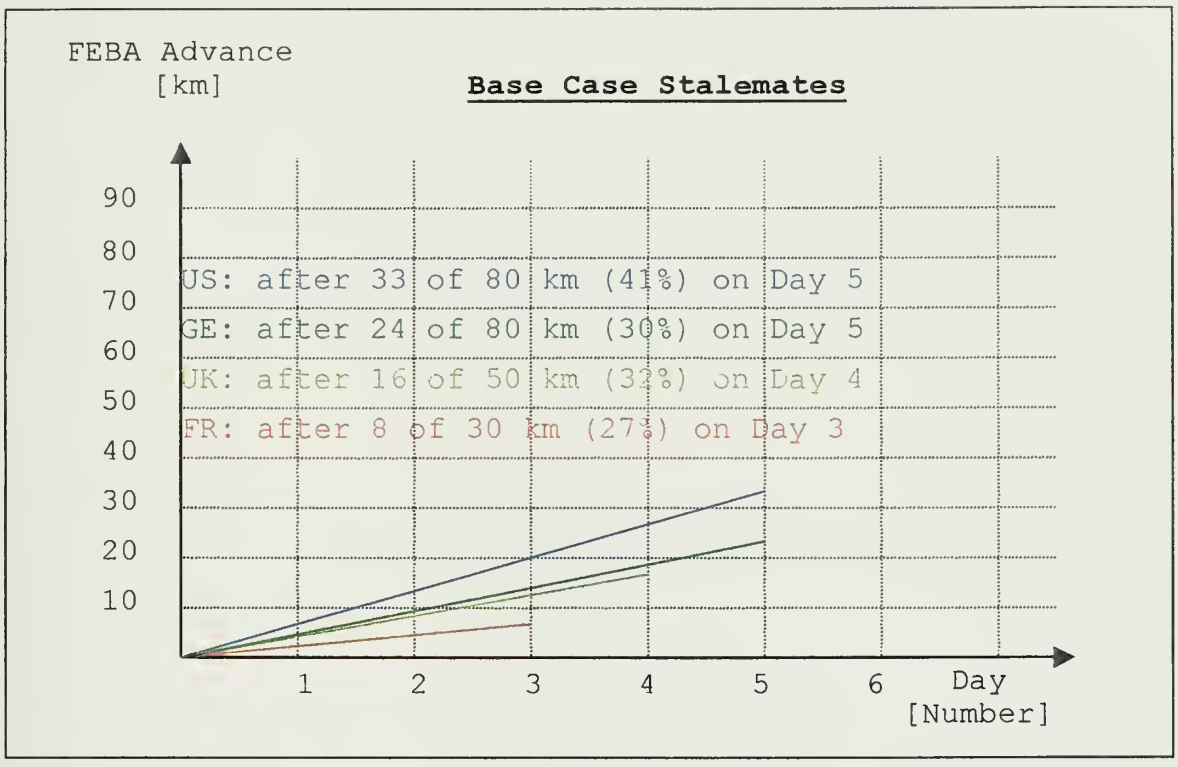

Figure 5.1. *The base case shows that if Serbia has all AT assets available and uses them effectively, the NATO divisions wouldn't seize their objectives.*

The fact that this outcome is driven by the weapon category "infantry assets"—for which Serbia has high numbers and which reflect the inclusion of the security, paramilitary, and police forces—suggests that a significant increase of the infantry asset numbers in the four NATO divisions would change the result. But this is not the

case. Even the tripling of the infantry assets still results in unsatisfactoring outcomes. The GE division then has to abort the attack after 28 km on day 5, the UK division after 21 km on day 5, the US division after 43 km on day 6, and the FR division after 12 km on day 4 (see Figure 5.2 below).

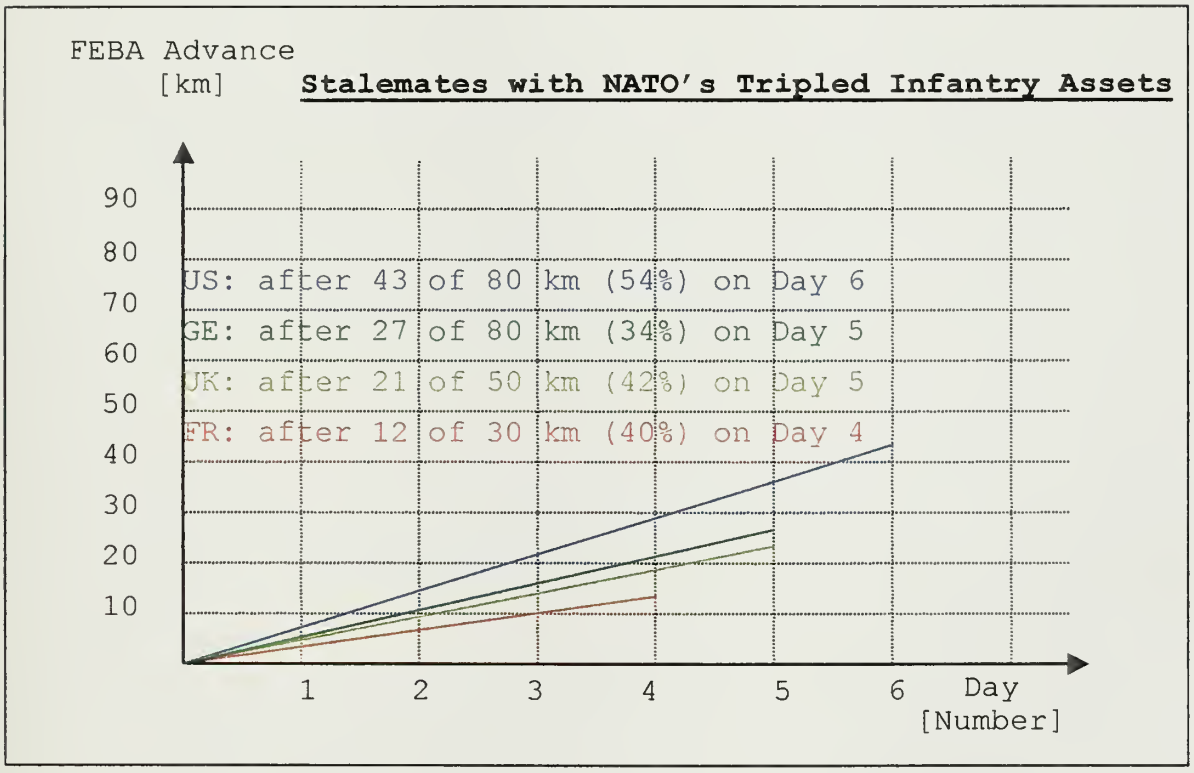

Figure 5.2. *Even with tripled infantry assets, the NATO divisions don't seize their objectives if Serbia has all AT assets available.*

The next step of the analysis is a closer look at the scores and multipliers of calculation steps 1 to 9 of the SFS methodology. Given that the values for asset scores, situational category multipliers, and shortage category multipliers—obtained from RAND sources [Ref. 16 and 18]—are realistic, a consideration about the force multipliers must be made. The force multipliers mainly reflect the level of training, cohesiveness, and nationality [Ref. 16] of a unit. Since the scenario is an invasion—after a sufficient training phase for both attacker and defender—it is not realistic to assume that the values of the force multipliers on the NATO side would be higher than on Serbia's side. Rather, these values might be higher for Serbian units which—motivated by a lasting propaganda that refers cleverly to historic events—defend its own territory. Furthermore, examples from recent military history (e.g., the Falklands War in 1982, the Gulf War in 1991) indicate that there are, within one nation's forces, different categories of training, cohesiveness, and motivation already on battalion level. Since the resolution of this campaign analysis is division or army level, no significant difference between NATO's and Serbia's force multipliers is feasible. The author applied a difference of

50% (i.e. force multiplier NATO equals 1.0, that of Serbia equals 1.5) with no significant influence on the outcome.

Finally, it turns out that the number of anti-tank (AT) assets is the key element for the defender. In conjunction with its situational category multiplier (approximately three times higher for the defender due to the terrain and the type of battle), this number is more than 10 times higher on Serbia's side than on the NATO side. The author would like to remind the reader that the enormous number of Serbia's AT assets results from recoilless rifles.

An analysis without the inclusion of Serbia's recoilless rifles results in a successful NATO ground forces campaign, as shown in Figure 5.3 below. The GE, UK, and US division seize their objectives in less than a week; parallel, the FR division ends up close to its objective before the casualties increase exponentially.

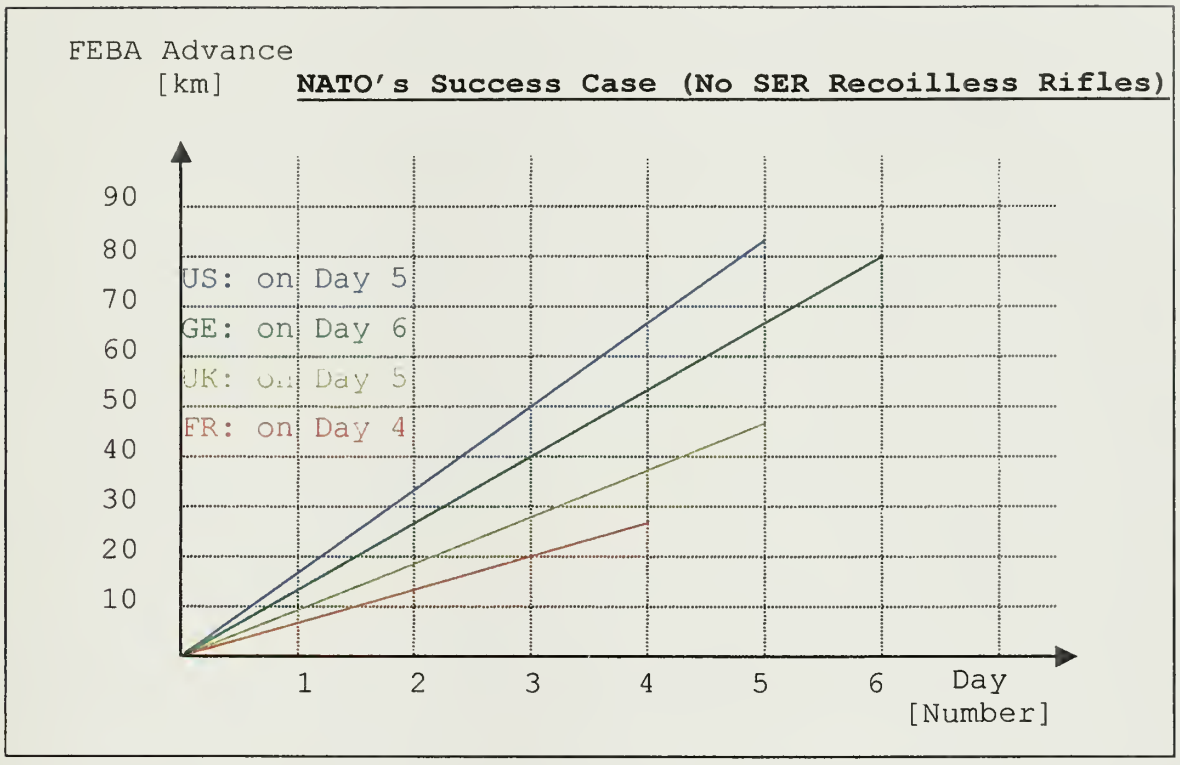

Figure 5.3. *The success of the NATO ground forces campaign depends on Serbia's access to AT weapons.*

Still unsatisfatory, though, are the high numbers of lethal casualties for NATO. The GE division counts 1194 casualties in the category "infantry assets", which by the above mentioned rule of thumb of 1:3 [Ref. 15] are 298 lethal casualties. These are 20.7% of the infantry asset strength and—given that Germany, like the three other nations, is in theater with 20,000 troops—1.5% of the

overall strength. The UK division has 1003 infantry asset casualties, resulting in 250 lethal casualties which are 20.4% of the infantry asset strength and 1.3% of the overall British strength. The US division suffers 432 casualties, i.e. 108 lethal casualties. Thus, these US losses are 14.9% of the infantry asset strength and 0.6% of the overall strength. Finally, the FR division has 829 casulties resulting in 207 lethal ones. These are 21.0% of infantry asset strength and 1% of all FR troops in theater. The overview of NATO's casualties which add up to 3,458—from which 863 are lethal—is shown in Table 5.4 below.

	Days	km [of max. km]	Casualties	Lethal Casualties	Leth. Cas. in % of Inf. Assets	Leth. Cas. in % of Strength
GE	6	78 [80]	1194	298	20.69%	1.49%
UK	5	47 [50]	1003	250	20.42%	1.25%
US	5	84 [80]	432	108	14.88%	0.54%
FR	4	25 [30]	829	207	21.02%	1.04%

Table 5.4. *The casualties on NATO's side are relatively high even in the case where the NATO divisions seize their objectives.*

Thus, the first MOE—minimizing friendly casualties—is not fulfilled while the second one—successfully ending the campaign as soon as possible—is fulfilled.

It is now up to the military decision leader to draw conclusions and make recommendations for the political level. On the one hand, due to the time line of the preparation phase, serviceability of older equipment and the availability of the respective well-trained personnel cannot be neglected. On the other hand, due to its technological superiority, NATO can foresee effective counter-measurements in its operations plan—e.g., reinforcement of artillery and mortar components—to minimize the effectiveness of these types of weapons. Additionally, to further reduce the number of casualties, other NATO nations might be requested to reinforce the four divisions with infantry-heavy units.

The tactical approach of the attack might also be adjusted. The faster the attack can be advanced, the less effectively can these old AT weapons—which need close-range and only slow moving targets—engage mechanized forces. Thus, a strong engineer support element for the attacking units must be as close to the spearheads as possible. In addition, air reconnaissance must focus on barriers in the depth of the battle field—heavily favored by the mountainous and channeling terrain, which simultaneously suppresses outflanking and the support for and from neighboring units—as early as possible. Airborne breaching forces can further ensure that the attack does not slow

down. Furthermore, airborne troops (e.g. 82nd (US) Airborne Division, 101st (US) Air Assault Division) are able to seize and secure key infrastructural targets—like bridges or tunnels—to guarantee the quick advance of the attacking forces.

Close air support (CAS) and the availability of attack helicopters can secure the flanks of advancing troops. Additionally, aerial strike forces have to engage all southward advancing units of the 1st (SER) Army to prevent them from further changing the force ratio to the disadvantage of NATO.

A clearly structured spreadsheet containing the SFS methodology could be created in a reasonable amount of time. The advantage is the fact that the numbers and values can be changed without the need to create a new code. Thus, a sensitivity analysis starting from a base case can be done easily with this created tool.

VI. SUMMARY AND RECOMMENDATION FOR FURTHER WORK

This campaign analysis wanted to evaluate the outcome of a NATO ground forces campaign in Kosovo—launched in order to end ethnic cleansing in Kosovo and to coerce Serbian forces to withdraw from Kosovo. Based on unclassified data, the level for this campaign analysis was that of the Supreme Allied Commander Europe (SACEUR). Thus, the resolution level on NATO's side was the division level and that on Serbia's side the level of armies. Simultaneously, a guerilla warfare element was integrated. This campaign analysis focused on ground forces, so air support was not added.

Besides the tactical results, the developed model should serve as a starting point for the development of a decision support tool for joint contingency planning on the division level and higher.

For the model, the situational force scoring (SFS) methodology, developed by RAND, was chosen. The decision was driven by the fact that the documentation for this methodology is clearly structured. Furthermore, the respective data for the equipment used in this scenario was available in the documentation and could be completed by updates on RAND's web site. A possible further study might

compare this analysis' results with those gained by using the methodology and sources of the Dupuy Institute.

The original idea of implementing the chosen methodology in GCAM™ was feasible at the time of the decision. During the process, though, it has turned out, that GCAM™ is better suitable for a longer and more detailed analysis process. Nevertheless, to indicate its capability, GCAM™ was used to determine constraints for the pre-war phases considering partisan warfare among other factors. Eventually, the core of the campaign analysis was supported by a spreadsheet containing the model with the implementd SFS methodology.

The operational scenario for this campaign analysis was based on the results of a proceding study and the study of the Balkan's military history in World War II. Recently published sources [Ref. 43] underline the realism of the chosen scenario.

A key factor for warfare on the Balkans is the terrain. It prevents mechanized forces from displaying its high-tech based superiority and enables the defender to withstand supposedly superior equipped enemies. It even allows the defender to use rather old equipment effectively.

Although the operational approach successfully divides Serbia's forces, a NATO ground forces campaign in Kosovo

will only be successful, if tactical and technological measures can reduce significantly the defender's use of AT weapons. Even then, the casualties on the attacker's side are relatively high and can only be further decreased by a massive use of high-tech army equipment, e.g. helo support, artillery and drones. But the mountainous and channeling terrain limits the number of units and weapon systems that can simultaneously engage the enemy. Additionally, the effectiveness of close air support (CAS) is also limited by the terrain and depends highly on the weather conditions.

With the developed spreadsheet—containing the implementation of RAND's SFS methodology—the basis for a decision support tool for joint contingency planning has been made. It enables a higher headquarters (HQ) to obtain a quick response on an uprising crisis. With this kind of campaign analysis under time pressure, a disaster later in the field due to the deployment of mismatching forces can be avoided. For later reinforcements of these forces, more detailed and time-intensive models—like GCAM™—might be applied.

The author suggests further work to be done in three areas. One the one hand, the existing model needs to be refined as far as scores and modifiers are concerned. On the other hand, the respective tools for an air campaign and

a navy campaign must be added to reach the goal of building a tool for joint decision purposes. And finally, it would be helpful for both the briefing analyst and the decision maker to have a visualization tool for the spreadsheet results.

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ANNEX A: BLUE FORCES (NATO)

Equipment (in analogy to the types of assets required for the SFS methodology, see Chapter III.A.1):

	Tanks	ARV,IFV	APC (w/o AT)	AT	Inf assets (Mrt<100, troops)	GunArty (SP,towed, Mrt>100)	MLRS	AH	AD
FRANCE:									
2nd (FR) Armored Division	174	76	96	42	985	42	24	18	72
Armd Regt	70		8						
Armd Regt	70		8						
Mech Inf Regt	17	38	14	8		6			
Mech Inf Regt	17	38	14	8		6			
Mech Inf Regt (wheeled)			52	8		6			
Recce Sqn				6					
Armd Anti-tank Sqn				12					
SP Arty Regt						24			
GERMANY:									
7. (GE) Panzerdivision	318	390	24	54	1440	156	24	18	72
PzGrenBrig 19	106	118	12	18		44			
PzBrig 21	106	118		18		44			
PzGrenBrig 22	106	118	12	18		44			
ArtRgt 7						24	24		
FlaRgt 1									72
PzAufklBtl 7		36							
UNITED KINGDOM:									
1 (UK) Armored Division	300	306	240	24	1224	120	18	24	36
4 Armored Brigade	100	90	80	8		32			
7 Armored Brigade	100	90	80	8		32			
20 Armored Brigade	100	90	80	8		32			
DAG						24	18		36
Armd Recce Regt		36							
Aviation Regt								24	
USA:									
1st (US) Infantry Division (Mech)	247	215	0	16	726	114	18	48	44
1st Brigade	88	44				18			
1st Bn/16th InfReg		44				6			
1st Bn/34th Armor Reg	44					6			
2nd Bn/34th Armor Reg	44					6			
2nd Brigade	44	88				18			
1st Bn/18th Inf Reg		44				6			
1st Bn/26th InfReg		44				6			
1st Bn/77th Armor Reg	44					6			
3rd Brigade	88	44				18			
2nd Bn/2nd InfReg		44				6			
1st Bn/63rd Armor Reg	44					6			
2nd Bn/63rd Armor Reg	44					6			
4th Brigade	27	39		16		6		48	
1st Bn/1st Aviation Reg								24	
2nd Bn/1st Aviation Reg								24	
1st Sqn/4th Cavalry Reg	27	39		16		6			
Division Artillery						54	18		
1st Bn/5th FA Reg						18			
1st Bn/7th FA Reg						18			
1st Bn/6th FA Reg						18			
A battery/33rd FA Reg							18		
3rd Bn/1st ADA Reg									44

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ANNEX B: ORANGE FORCES (SERBIA)

Equipment (in analogy to the types of assets required for the SFS methodology, see Chapter III.A.1):

Unit:	Location	Tanks	ARV,IFV	APC (w/o AT)	AT	Inf assets (Mrt<100, troops)	GunArty (SP,towed, Mrt>100)	MLRS	AH	AD
Serbian Army (3 armies w/ 8 army corps + Belgrade Def HQ):		639	577	172	3,755	46,760	1,466	144	0	1,662
1st (SER) Army	Belgrade	284	257	77	1,669	20,782	652	64	0	739
Mechanized Corps	Belgrade									
252nd Armored Brigade	Kraljevo									
1st Mechanized Brigade	Belgrade									
2nd Mechanized Brigade	Valjevo									
3rd Mechanized Brigade	Pozarevac									
35th Motorised Brigade	Mladenovac									
1st Mixed Artillery Brigade	Kragujevac									
Novi Sad Corps	Novi Sad									
36th Mechanized Brigade	Subotica									
453rd Mechanized Brigade	Sremska Mitrovica									
12th Mechanized Brigade	Sombor									
18th Motorised Brigade	Novi Sad									
127th Light Infantry Brigade	Novi Sad									
16th Mixed Artillery Brigade	Ruma									
16th Mixed Anti-Tank Artillery Brigade	Backa Topola									
Belgrade Defense HQ	Belgrade									
151st Motorised Brigade	Belgrade									
505th Motorised Brigade	Belgrade									
153rd Light Motorised Brigade	Obrenovac									
22nd Mixed Artillery Brigade	Belgrade									
150th Light Motorised Brigade	Lazarevac									
22nd Mixed Anti-Tank Artillery Regiment	Belgrade									
585th Light Infantry Brigade Group	Belgrade									
Reserve Brigade	Belgrade									
Reserve Brigade	Belgrade									
Reserve Brigade	Belgrade									
Reserve Brigade	Belgrade									
Kragujevac Corps	Kragujevac									
51st Mechanized Brigade	Pancevo									
80th Motorised Brigade	Kragujevac									
130th Motorised Brigade	Smederevska Palanka									
129th Light Motorised Brigade	Apatin									
20th Light Infantry Brigade	Pozarevac									
21st Light Infantry Brigade	Svetozarevo									
24th Mixed Artillery Regiment/Brigade	Smederevska Palanka									
Special Forces Corps	Belgrade									
Motorised Guards Brigade	Belgrade									
Motorised Guards Brigade	Belgrade									
63rd Parachute Brigade	Nis									
72nd Special Forces Brigade	Pancevo									
Task Force Banat	Zrenjanin									
14th Light Motorised Brigade	Kikinda									
Task Force Drina	Loznica									
544th Motorised Brigade	Sabac									
208th Mixed Artillery Regiment	Valjevo									
310th SAM Regiment	?									
149th SAM Regiment	?									
240th SAM Regiment	?									
2nd (SER) Army	Podgorica	142	128	38	834	10,391	326	32	0	369
Podgorica Corps	Podgorica									
5th Motorised Brigade	Podgorica									
57th Motorised Brigade	Pljevlja									
179th Motorised Brigade	Niksic									
3rd Light Infantry/Light Motorised Brigade	Ivangrad									
2nd Light Mountain Brigade	Podgorica									
4th Light Infantry Brigade	Kolasin									
326th Mixed Artillery Brigade	Danilovgrad									
Uzice Corps	Uzice									
37th Motorised Brigade	Raska									
168th Motorised Brigade	Novi Pazar									
27th Light Motorised Brigade	Kraljevo									
134th Light Infantry Brigade	Uzice									
6th Light Infantry Brigade	Priboj									
7th Light Infantry Brigade	Nova Varos									
202nd Mixed Artillery Brigade	Cacak									
60th SAM Regiment	?									

ANNEX B: ORANGE FORCES (SERBIA)

Unit:	Location:	Tanks	ARV,IFV	APC (w/o AT)	AT	Inf assets (Mrt<100, troops)	GunArty (SP,towed, Mrt>100)	MLRS	AH	AD
3rd (SER) Army	Nis	213	192	57	1,252	15,587	488	48	0	554
Nis Corps	Nis									
4th Motonsed Bngade	Pirot									
2nd Motonsed Bngade	Nis									
211st Armored Bngade	Nis									
805th Motonsed Bngade	Prokuplje									
50th Light Infantry Bngade	Aleksinac									
21st Mixed Anti-Tank Bngade	Leskovac									
203rd Mixed Artillery Bngade	Nis									
Leskovac Corps	Leskovac									
89th Motonsed Bngade	Vranje									
135th Motonsed Bngade	Surdulica									
13th Light Motonsed Bngade	Leskovac									
42nd Mixed Anti-Tank Regiment/Bngade	Vranje									
Pnstina Corps	Pnstina									
243rd Armored Bngade	Urosevac									
15th Mechanized Bngade	Pnstina									
549th Motonsed Bngade	Pnzren									
58th Light Mechanized/Motonsed Bngade	Leposavic									
52nd Mixed Artillery Bngade	Gnjilane									
102nd Mixed Anti-Tank Bngade	Vranje									
150th Mixed Artillery Bngade	Vranje									
Task Force Timok	Zajecar									
148th Motonsed Bngade	Negotin									
9th Motonsed Bngade	Zajecar									
23rd Light Infantry Bngade	Bor									
35th Light Infantry Bngade	Negotin									
311st SAM Regiment	?									
Security & Paramilitary & Police Forces & MUP						86,000				

Details about the Army equipment:

Tanks	639		[400 T-54/T-55, 239 M-84A, (181 T-34)]
ARV, IFV	577		[30 BRDM-1, 30 BRDM-2, 517 BVP M-80A]
APC (w/o AT)	172		[112 M-60P, 60 BOV-1]
AT	3,755	555	[30 Sagger BRDM-1, 10 Sagger BRDM-2, 60 Sagger BOV-1, 130 M-87 TOPAZ (100-mm), 70 M-36B2(90-mm), 60 M-18 Hellcat(76-mm), 60 PAK-40(76-mm), 135 AT-3 Sagger]
incl. Recoilless Rifles		3,200	[650 M-65(105-mm), 1000 M-60 PB(82-mm), 1550 M-18(57-mm)]
Infantry assets (Mrt<100mm, troops)	46,760	1,760	[60 M-48(76-mm), 1700 M-31/M-68(82-mm)]
		45,000	
GunArtillery (self-prop,	1,466	666	[24 M-65(155-mm), 40 M-84B(152-mm), 25 D-20(152-mm), 48 M-1973(152-mm), 75 2S1(122-mm), 130 D-30J(122-mm), 150 M-1931/37(122-mm), 174 M-56(105-mm)]
towed, Mrt>100mm)		240	[60 M-59(155-mm), 180 M-46(130-mm)]
		560	[560 UB M-52&M-74/75(120-mm)]
MLRS	144		[24 M-77/YMRL-32(128-mm), 48 M-85/M-63(128-mm), 72 RL M-71(128-mm)]
AH	0		
AD (AAD, SAM)	1,662	952	[8 BOV-30(twin 30-mm), 65 BOV-3(triple 20-mm), 54 ZSU-57-2, 350 M-53(twin 30-mm), 475 M-55(triple 20-mm)]
		710	[80 SA-6 Gainful, 500 SA-7 Grail, 130 SA-9 Gaskin]

ANNEX C: OPPOSING FORCES, SCORES, AND MULTIPLIERS

Assets 7.(GE) Panzerdivision vs. 3rd (SER) Army (half strength):

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
GE	318	390	24	54	1440	156	24	18	72
SER	106	96	28	626	7943	244	24	0	277

Assets 1 (UK) Armored Division vs. 3rd (SER) Army (half strength):

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
UK	300	306	240	24	1224	120	18	24	36
SER	107	96	29	626	7944	244	24	0	277

Assets 1st (US) Infantry Division (MECH) vs. 2nd (SER) Army (half strength):

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
US	247	215	0	16	726	114	18	48	44
SER	71	64	19	417	5195	163	16	0	184

Assets 2nd (FR) Armored Division vs. 2nd (SER) Army (half strength):

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
FR	174	76	96	42	985	42	24	18	72
SER	71	64	19	419	5196	163	16	0	185

Scores:

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
GE	7.5	3.5	1	1.2	0.3	5	10	3.5	1.5
UK	7.5	3.5	1	1.2	0.3	5	10	3.5	1.5
US	7.5	3.5	1	1.2	0.3	5	10	10	1.5
FR	7.5	3.5	1	1.2	0.3	5	10	3.5	1.5
SER	3	2.4	1	0.8	0.08	1.9	2.6	1	0.6

Force Multipliers:

GE	1
UK	1
US	1
FR	1
SER	1

Situational Multipliers:

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
GE	0.76	0.76	0.532	0.758	1.216	0.76	0.76	0.758	0.76
UK	0.76	0.76	0.532	0.758	1.216	0.76	0.76	0.758	0.76
US	0.76	0.76	0.532	0.758	1.216	0.76	0.76	0.758	0.76
FR	0.76	0.76	0.532	0.758	1.216	0.76	0.76	0.758	0.76
SER	0.88	0.88	0.616	2.08	2.08	0.88	0.88	1.092	0.88

Shortage Multipliers:

	Tanks	ARV, IFV	APC	AT	Inf Assets	GunArty	MLRS	AH	AD
GE	0.8	0.8	0.4	0.8	0.2	0.6	0.6	0.8	0.6
UK	0.8	0.8	0.4	0.8	0.2	0.6	0.6	0.8	0.6
US	0.8	0.8	0.4	0.8	0.2	0.6	0.6	0.8	0.6
FR	0.8	0.8	0.4	0.8	0.2	0.6	0.6	0.8	0.6
SER	0.8	0.8	0.4	0.8	0.2	0.6	0.6	0.8	0.6

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ANNEX D: SOURCE CODE GCAM™

```
#MASTER
      title = Kosovo;

//files
      trigger files = trigger1.trg, tables.trg, red2army.trg,
                  red3army.trg, red1army.trg, partisanmontenegro.trg,
                  nato.trg;
      unit files = red1army.unt, red2army.unt, red3army.unt,
                  partisanmontenegro.unt,
                  nato.unt;
      sensor files = sensorpartisanmontenegro.sen,
                  NATO.sen, RED.sen;
      output control files = targetssensoredbypzbrig9.ctl;

//coordinate system and map definition
      time per turn = 5MINUTES;
      maps = balkan(C:\GCAM\Kosovo\map3.bmp, 0, 0, 622.22,737.04),
                  kosovo(C:\GCAM\Kosovo\map4.bmp, 349.00,216.00,
                  523.44,422.67);

//sprite display control
      sprite registrations =
      1army(C:\GCAM\Kosovo\KosovoSprites\1army.bmp, 4, 25, 25, 1,
            FALSE),
      mechcorps(C:\GCAM\Kosovo\KosovoSprites\mechcorps.bmp, 4, 12, 20,
            1, FALSE),
      novisadcorps(C:\GCAM\Kosovo\KosovoSprites\novisadcorps.bmp, 4,
            12, 20, 1, FALSE),
      kragujevaccorps(C:\GCAM\Kosovo\KosovoSprites\kragujevaccorps.bmp,
            4, 12, 20, 1, FALSE),
      sfcorps(C:\GCAM\Kosovo\KosovoSprites\sfcorps.bmp, 4, 12, 20, 1,
            FALSE),
      hqdivbelgrade(C:\GCAM\Kosovo\KosovoSprites\hqdivbelgrade.bmp, 4,
            11, 18, 1, FALSE),
      taskforcedrina(C:\GCAM\Kosovo\KosovoSprites\taskforcedrina.bmp,
            4, 13, 19, 1, FALSE),
      taskforcebanat(C:\GCAM\Kosovo\KosovoSprites\taskforcebanat.bmp,
            4, 13, 19, 1, FALSE),
      2army(C:\GCAM\Kosovo\KosovoSprites\2army.bmp, 4, 25, 26, 1,
            FALSE),
      podgoricacorps(C:\GCAM\Kosovo\KosovoSprites\podgoricacorps.bmp,
            4, 13, 21, 1, FALSE),
      uzicecorps(C:\GCAM\Kosovo\KosovoSprites\uzicecorps.bmp, 4, 13,
            21, 1, FALSE),
      202artybrig(C:\GCAM\Kosovo\KosovoSprites\202artybrig.bmp, 4, 24,
            17, 1, FALSE),
      3army(C:\GCAM\Kosovo\KosovoSprites\3army.bmp, 4, 25, 25, 1,
            FALSE),
      niscorps(C:\GCAM\Kosovo\KosovoSprites\niscorps.bmp, 4, 13, 21, 1,
            FALSE),
      leskovaccorps(C:\GCAM\Kosovo\KosovoSprites\leskovaccorps.bmp, 4,
            13, 21, 1, FALSE),
      pristinacorps(C:\GCAM\Kosovo\KosovoSprites\pristinacorps.bmp, 4,
            13, 21, 1, FALSE),
```

```
      150artybrig(C:\GCAM\Kosovo\KosovoSprites\150artybrig.bmp, 4, 24,
            17, 1, FALSE),
      taskforcetimok(C:\GCAM\Kosovo\KosovoSprites\taskforcetimok.bmp,
            4, 13, 19, 1, FALSE),
      usdiv(C:\GCAM\Kosovo\KosovoSprites\usdiv.bmp, 4, 12, 17, 1,
            FALSE),
      gediv(C:\GCAM\Kosovo\KosovoSprites\gediv.bmp, 4, 12, 17, 1,
            FALSE),
      gepzbrig9(C:\GCAM\Kosovo\KosovoSprites\gepzbrig9.bmp, 4, 18, 14,
            1, FALSE),
      gepzgrenbrig1(C:\GCAM\Kosovo\KosovoSprites\gepzgrenbrig1.bmp, 4,
            18, 14, 1, FALSE),
      gepzgrenbrig7(C:\GCAM\Kosovo\KosovoSprites\gepzgrenbrig7.bmp, 4,
            18, 14, 1, FALSE),
      ukdiv(C:\GCAM\Kosovo\KosovoSprites\ukdiv.bmp, 4, 12, 17, 1,
            FALSE),
      frdiv(C:\GCAM\Kosovo\KosovoSprites\frdiv.bmp, 4, 12, 17, 1,
            FALSE),
      partisanmontenegro(C:\GCAM\Kosovo\KosovoSprites\partisanmontenegr
            o.bmp, 4, 16, 14, 1, FALSE);

//unit report display control
      unit classification hierarchy = environment, size, branch;
      force membership hierarchy = player;

//GAME window display control
      initial workspace = InitialWorkspace.wsp;
      workspace changes = AllBlueDivReadyForAttack
                              (C:\GCAM\Kosovo\SecondWorkspace.wsp);

//simulation control
      end trigger =EndSim;
      number of simulations = 1;
      evaluation order = EXPLICIT ORDERS GENERATION, FORCE MEMBERSHIP,
                  SENSOR MANAGEMENT, REPORTING CHAIN CHANGES, CONTACT
                  LIST GENERATION, QUEUE MANIPULATIONS, MOTION,
                  POSTURE, DAMAGE AND REPAIR, INVENTORY MANIPULATIONS;

//registered inventory class specifications
      registered inventory classes = Tk, IFV, RV, Mrt, Arty, AT, AAA,
            SAM, SmA1, SmA2, Trucks, Troops;
      registered inventory identifiers = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
            11, 12;

#END



#TRIGGERS

      -statistic 1km = 1;
//    maps = map3(C:\GCAM\Kosovo\map3.bmp, 0, 0, 622.22,737.04);
      -statistic 1hr = 12;
//    time per turn = 5 MINUTES;
      -statistic 90min = 1.5 * 1hr;
      -statistic 2hrs = 2 * 1hr;
      -statistic 3hrs = 3 * 1hr;
```

```
      -statistic 3.5hrs = 3.5 * 1hr;
      -statistic 4hrs = 4 * 1hr;
      -statistic 5hrs = 5 * 1hr;
      -statistic 6hrs = 6 * 1hr;
      -statistic 12hrs = 12 * 1hr;
      -statistic 17hrs = 17 * 1hr;
      -statistic 24hrs = 24 * 1hr;
      -statistic 30hrs = 30 * 1hr;
      -statistic 32hrs = 32 * 1hr;
      -statistic 36hrs = 36 * 1hr;
      -statistic 72hrs = 72 * 1hr;
      -statistic 1day = 24 * 1hr;
      -statistic 2days = 2 * 1day;
      -statistic 3.5days = 3.5 * 1day;
      -statistic 13days = 13 * 1day;
      -statistic 14days = 14 * 1day;
      -statistic 16days = 16 * 1day;
      -statistic 18.75days = 18.75 * 1day;
      -statistic 28days = 28 * 1day;

      -statistic h0000 = 0 * 1hr;
      -statistic h0030 = 0.5 * 1hr;
      -statistic h0600 = 6 * 1hr;
      -statistic h2330 = 23.5 * 1hr;

      -statistic d00 = 0 * 1day;
      -statistic d01 = 1 * 1day;
      -statistic d04 = 4 * 1day;
      -statistic d15 = 15 * 1day;

      -statistic d00h0030 = d00 + h0030;
      -statistic d01h0030 = d01 + h0030;
      -statistic d01h0600 = d01 + h0600;
      -statistic d04h0000 = d04 + h0000;
      -statistic d15h0000 = d15 + h0000;
      -statistic 1kmh = 1km/1hr;
      -statistic 2kmh = 2*1kmh;
      -statistic 3kmh = 3*1kmh;
      -statistic 5kmh = 5*1kmh;
      -statistic 10kmh = 10*1kmh;
      -statistic 15kmh = 15*1kmh;
      -statistic 20kmh = 20*1kmh;
      -statistic 25kmh = 25*1kmh;
      -statistic 40kmh = 40*1kmh;

#END


#TRIGGERS

      statistic currentturn = global, ONTURN;
      condition cEndSim =currentturn =10000;
      trigger EndSim = cEndSim;
      -trigger Always = [global, ONTURN > -1];
      -trigger Never = !Always;
```

```
      -trigger DayTimeStarts = [global, PERIODIC(24hrs, 5hrs) = 1];
      -trigger NightTimeStarts = [global, PERIODIC(24hrs, 17hrs) = 1];

#END


#TRIGGERS

      statistic withdrawel2army = global, VECTOR(300.3,308.5,
            307.1,326.8, 308.3,345.1, 322.0,352.0, 335.7,353.1,
            339.1,372.5, 337.9,390.8, 348.2,405.7, 359.6,415.9,
            360.8,434.2, 357.3,450.2, 348.2,463.9);
      statistic withdrawelpodgoricacorps = global, VECTOR(264.9,297.1,
            260.3,310.8, 256.9,325.7, 258.0,341.7, 274.0,341.7,
            286.6,355.4, 295.7,369.1, 298.0,386.2, 304.8,404.5,
            310.5,417.1, 332.2,410.2, 350.5,403.4, 365.3,395.4,
            381.3,378.2, 399.6,362.2, 415.6,348.5, 405.3,331.4,
            400.7,314.2);
      statistic withdraweluzicecorps = global, VECTOR(342.5,463.9,
            342.5,445.7, 342.5,429.7, 334.5,413.7, 337.9,398.8,
            351.6,388.5);
      statistic withdrawel202artybrig = global, VECTOR(302.5,391.9,
            310.5,399.9, 317.4,417.1, 331.1,423.9, 351.6,422.8,
            367.6,423.9, 364.2,443.4, 356.2,460.5, 352.8,471.9,
            360.8,483.4, 383.6,474.2, 395.0,467.4, 404.2,455.9,
            415.6,449.1);

#END


#TRIGGERS

      statistic withdrawel3army = global, VECTOR(512.6,409.1,
            504.6,422.8, 498.9,434.2, 486.4,441.1, 476.1,447.9,
            471.5,463.9);
      statistic withdrawelleskovaccorps = global, VECTOR(527.5,374.8,
            529.7,362.2, 535.5,350.8, 532.0,337.1, 524.0,328.0,
            520.6,320.0);
      statistic withdrawelniscorps = global, VECTOR(488.6,394.2,
            496.6,402.2);
      statistic withdrawelpristinacorps = global, VECTOR(453.3,331.4,
            446.4,323.4, 447.5,313.1);
      statistic withdrawel150artybrig = global, VECTOR(529.7,324.5,
            534.3,336.0, 536.6,349.7, 535.5,362.2, 527.5,371.4,
            519.5,387.4);
      statistic withdraweltaskforcetimok = global, VECTOR(414.4,277.7,
            424.7,289.1, 429.3,297.1, 440.7,308.5, 447.5,322.2,
            454.4,330.2, 465.8,342.8, 479.5,345.1, 486.4,354.2,
            497.8,363.4, 511.5,367.9, 524.0,372.5, 522.9,383.9,
            512.6,393.1, 518.3,403.4, 528.6,412.5);

#END
```

```
#TRIGGERS

      statistic withdrawel1army = global, VECTOR(393.9,572.5,
            393.9,563.4, 395.0,551.9, 400.7,543.9, 409.9,533.6);
      statistic withdrawelmechcorps = global, VECTOR(399.6,606.8,
            404.2,594.2, 412.1,583.9, 412.1,571.3, 422.4,563.4,
            431.6,555.4, 440.7,542.8);
      statistic withdrawelnovisadcorps = global, VECTOR(345.9,619.3,
            353.9,626.2, 357.3,639.9, 347.1,647.9, 333.4,654.8);
      statistic withdrawelkragujevaccorps = global, VECTOR(430.4,482.2,
            429.3,495.9, 421.3,507.4, 403.0,505.1, 388.2,507.4,
            372.2,515.4, 363.1,525.6, 369.9,534.8);
      statistic withdrawelsfcorps = global, VECTOR(359.6,561.1,
            353.9,571.3, 351.6,583.9, 341.4,591.9, 332.2,601.1,
            333.4,614.8, 342.5,623.9, 334.5,630.8, 320.8,641.1,
            306.0,658.2, 295.7,669.6, 288.8,679.9, 306.0,692.5,
            325.4,705.0, 335.7,710.8, 351.6,706.2, 361.9,691.3,
            359.6,674.2, 363.1,649.1, 368.8,631.9, 389.3,630.8,
            404.2,627.3, 421.3,621.6, 437.3,614.8, 453.3,606.8,
            451.0,594.2, 445.3,582.8, 436.1,570.2, 430.4,555.4,
            420.1,547.4, 404.2,545.1, 383.6,545.1, 365.3,546.2,
            347.1,547.4, 342.5,535.9, 345.9,517.6, 351.6,508.5);
      statistic withdrawelhqdivbelgrade = global, VECTOR(425.8,567.9,
            414.4,569.1, 406.4,575.9, 393.9,573.6);
      statistic withdraweltaskforcebanat = global, VECTOR(387.0,644.5,
            385.9,637.6, 387.0,623.9, 387.0,607.9, 389.3,593.1,
            389.3,579.3, 371.0,578.2, 361.9,586.2, 349.4,595.3,
            339.1,601.1, 327.7,596.5);
      statistic withdraweltaskforcedrina = global, VECTOR(325.4,686.8,
            318.5,678.8, 307.1,675.3, 295.7,671.9);

#END


#TRIGGERS

      statistic montenegro = global, VECTOR(240.9,306.2, 238.6,320.0,
            247.7,330.2, 246.6,341.7, 240.9,350.8, 242.0,358.8,
            240.9,369.1, 254.6,367.9, 256.9,379.4, 261.4,389.7,
            266.0,398.8, 272.9,401.1, 280.9,389.7, 288.8,398.8,
            291.1,406.8, 288.8,413.7, 282.0,425.1, 290.0,422.8,
            299.1,413.7, 308.3,407.9, 316.2,399.9, 322.0,390.8,
            329.9,386.2, 340.2,378.2, 349.4,374.8, 359.6,372.5,
            367.6,365.7, 372.2,361.1, 381.3,358.8, 385.9,354.2,
            376.8,350.8, 375.6,345.1, 367.6,348.5, 360.8,342.8,
            358.5,332.5, 363.1,329.1, 356.2,322.2, 349.4,320.0,
            345.9,330.2, 333.4,334.8, 325.4,328.0, 319.7,317.7,
            314.0,306.2, 308.3,298.2, 302.5,290.2, 299.1,281.1,
            301.4,272.0, 306.0,265.1, 302.5,249.1, 286.6,262.8,
            270.6,285.7, 255.7,296.0);

#END
```

```
#TRIGGERS

      statistic march1gediv = global, VECTOR(599.4,120.0, 586.8,123.4,
            585.7,138.3, 581.1,152.0, 575.4,164.5, 574.3,178.3,
            566.3,192.0, 554.9,198.8, 544.6,204.5, 533.2,213.7,
            522.9,219.4, 508.1,230.8);
      statistic march2gediv = global, VECTOR(508.1,230.8, 502.3,242.3,
            495.5,252.5, 484.1,260.5, 496.6,260.5, 504.6,266.2,
            505.8,275.4);
      statistic march1ukdiv = global, VECTOR(568.6,104.0, 559.4,102.8,
            545.7,98.3, 536.6,107.4, 534.3,118.8, 534.3,129.1,
            522.9,132.6, 510.3,132.6, 502.3,123.4, 488.6,123.4,
            480.7,125.7, 477.2,137.1, 477.2,147.4, 478.4,158.8,
            490.9,166.8, 495.5,173.7, 496.6,185.1, 492.1,189.7,
            488.6,195.4, 484.1,203.4, 481.8,214.8, 486.4,224.0,
            498.9,221.7, 508.1,230.8);
      statistic march2ukdiv = global, VECTOR(508.1,230.8, 502.3,237.7,
            495.5,248.0, 488.6,253.7, 478.4,258.2, 470.4,262.8,
            459.0,262.8, 449.8,265.1, 443.0,258.2);
      statistic march1usdiv = global, VECTOR(276.3,288.0, 284.3,299.4,
            292.3,306.2, 303.7,312.0, 308.3,324.5, 314.0,333.7,
            322.0,344.0);
      statistic march2usdiv = global, VECTOR(322.0,344.0, 326.5,352.0,
            331.1,361.1);
      statistic march1frdiv = global, VECTOR(319.7,185.1, 329.9,189.7,
            332.2,201.1, 333.4,214.8, 334.5,228.5, 331.1,241.1,
            327.7,253.7, 323.1,262.8);
      statistic march2frdiv = global, VECTOR(323.1,262.8, 334.5,266.2,
            344.8,268.5, 359.6,269.7, 372.2,270.8, 381.3,277.7);

#END


#TRIGGERS

      statistic partisanareamontenegro = global, VECTOR(296.8,413.7,
            315.1,398.8, 336.8,382.8, 360.8,371.4, 376.8,354.2,
            360.8,340.5, 347.1,333.7, 328.8,332.5, 318.5,321.1,
            283.1,345.1, 258.0,369.1, 262.6,394.2, 290.0,394.2);

#END


#TRIGGERS

      -^statistic random0to1 = global, NORMRAND;

#END


#TRIGGERS

      -$trigger AllBlueDivReadyForAttack = [unit-countsreadiness,
```

```
            QPOP(BlueUnitsReadyForAttack) = 4]&[unit-countsreadiness,
            QPOP(BlueUnitsReadyForAttack) < 4, 1-2];

#END


#TRIGGERS

      statistic attackgepzbrig9obj1 = global, VECTOR(501.6,280.6,
            501.6,284.1, 501.6,288.1, 501.9,292.2, 502.5,296.2,
            503.4,300.9, 503.1,305.0, 503.7,309.0, 505.0,311.5,
            508.1,314.3, 511.2,317.1, 514.1,320.0, 517.5,321.5,
            518.8,324.6, 516.6,327.8);
      statistic attackgepzgrenbrig1obj1 = global, VECTOR(513.7,288.1,
            512.5,291.2, 514.4,295.0, 517.5,297.8, 516.9,301.9,
            517.5,306.2, 516.2,310.6, 513.7,314.3, 511.6,316.8,
            513.7,319.0, 517.2,320.9, 520.6,323.7, 523.1,326.2);

#END


#TRIGGERS

      statistic attackboundarypzbrig9 = global, VECTOR(492.8,290.6,
            491.9,297.2, 493.4,301.9, 497.2,304.0, 498.4,309.0,
            498.7,313.7, 500.9,317.1, 504.1,321.5, 506.9,325.3,
            509.4,329.0, 514.4,329.3, 521.3,329.0, 522.2,321.5,
            519.4,317.1, 515.0,313.7, 511.9,309.7, 509.7,304.7,
            509.7,299.4, 509.7,295.9);

#END


#TRIGGERS

      -statistic mainfiringrange = global, VECTOR(
                        2.5,              //tank
                        1.1,              //IFV
                        6.0,              //Mrt
                        25.0,             //Arty
                        4.0,              //AT
                        5.5,              //AAA
                      //10.0,             //SAM
                        0.8);             //SmA

#END
```

```
#TRIGGERS

      -trigger AllUnits2ArmyArrived = [unit-2army, POS = (348.2,463.9),
            36hrs];

#END


#TRIGGERS

      -trigger AllUnitsPodgoricaCorpsArrived = [unit-podgoricacorps,
            POS = (400.7,314.2), 24hrs];

#END


#TRIGGERS

      -trigger FirstUnits2ArmyArrived = [unit-2army, POS =
            (348.2,463.9)];

#END


#TRIGGERS

      -trigger AllUnitsUziceCorpsArrived = [unit-uzicecorps, POS =
            (351.6,388.5), 24hrs];

#END


#TRIGGERS

      -trigger AllUnits202ArtyBrigArrived = [unit-202artybrig, POS =
            (415.6,449.1), 24hrs];

#END


#TRIGGERS

      -trigger AllUnits3ArmyArrived = [unit-3army, POS = (471.5,463.9),
            36hrs];

#END


#TRIGGERS

      -trigger AllUnitsTaskForceTimokArrived = [unit-taskforcetimok,
```

```
            POS = (528.6,412.5), 36hrs];

#END


#TRIGGERS

      -trigger AllUnits150ArtyBrigArrived = [unit-150artybrig, POS =
            (519.5,387.4), 30hrs];

#END


#TRIGGERS

      -trigger AllUnitsNisCorpsArrived = [unit-niscorps, POS =
            (496.6,402.2), 24hrs];

#END


#TRIGGERS

      -trigger AllUnitsLeskovacCorpsArrived = [unit-leskovaccorps, POS
            = (520.6,320.0), 24hrs];

#END


#TRIGGERS

      -trigger AllUnitsPristinaCorpsArrived = [unit-pristinacorps, POS
            = (447.5,313.1), 24hrs];

#END


#TRIGGERS

      -trigger AllUnits1ArmyArrived =  [unit-1army, POS =
            (409.9,533.6), 36hrs];

#END


#TRIGGERS

      -trigger AllUnitsMechCorpsArrived = [unit-mechcorps, POS =
            (440.7,542.8), 24hrs];
```

```
#END


#TRIGGERS

      -trigger AllUnitsNoviSadCorpsArrived = [unit-novisadcorps, POS =
            (333.4,654.8), 24hrs];

#END


#TRIGGERS

      -trigger AllUnitsKragujevacCorpsArrived = [unit-kragujevaccorps,
            POS = (369.9,534.8), 24hrs];

#END


#TRIGGERS

      -trigger AllUnitsHQDivBelgradeArrived = [unit-hqdivbelgrade, POS
            = (393.9,573.6), 32hrs];

#END


#TRIGGERS

      -trigger AllUnitsTaskForceDrinaArrived = [unit-taskforcedrina,
            POS = (295.7,671.9), 30hrs];

#END


#TRIGGERS

      -trigger AllUnitsTaskForceBanatArrived = [unit-taskforcebanat,
            POS = (327.7,596.5), 30hrs];

#END


#TRIGGERS

      -trigger AllUnitsSFCorpsArrived = [unit-sfcorps, POS =
            (351.6,508.5), 6hrs];

#END
```

```
#TRIGGERS

      -statistic blueid = unit-partisanmontenegro, CONTACT ID;
      -trigger PartisanDead = [unit-partisanmontenegro,
            INVENTORY(Troops) = 0];
      -trigger PartisanAcquiresTarget = [blueid != 0]&[random0to1 <
            0.75];
      -trigger PartisanEndsFight = [unit-partisanmontenegro,
            ORDERS(combat)=1, 4hrs];
      -statistic decreaseinventoryclasspartisanmontenegro = global,
            VECTOR(6, 9, 10, 11, 12);
      -statistic decreaseinventorynumberpartisanmontenegro = global,
            VECTOR(-1, -2, -1, -1, -2);

#END


#TRIGGERS

      -trigger BlueForcesArrive = [global, ONTURN = 24hrs];
      -trigger TaskForwardDeployment = [global, ONTURN = 18.75days];
      -trigger MapChange = [unit-countsreadiness,
            QPOP(BlueUnitsReadyForAttack) = 4]&[unit-countsreadiness,
            QPOP(BlueUnitsReadyForAttack) < 4, 1-2];
      -trigger TaskGroundForceAttack = [global, ONTURN =28days];

#END


#TRIGGERS

      -trigger AllUnitsGEDivArrived = [unit-gediv, POS = (600, 124),
            13days];
      -trigger FFGEDeployment = [unit-gediv, POS = (508.1,230.8)];
      -trigger GEDivPreparation = [unit-gediv, POS = (505.8,275.4)];
      -trigger GEDivReady =  [unit-gediv, POS = (505.8,275.4), 72hrs];

#END


#TRIGGERS

      -trigger AllUnitsUKDivArrived = [unit-ukdiv, POS = (575, 105),
            14days];
      -trigger FFUKDeployment =  [unit-ukdiv, POS = (508.1,230.8)];
      -trigger UKDivPreparation = [unit-ukdiv, POS = (443.0,258.2)];
      -trigger UKDivReady = [unit-ukdiv, POS = (443.0,258.2), 72hrs];

#END
```

```
#TRIGGERS

      -trigger USForcesArrive = ![unit-2army,  INPOLY(montenegro) =
            1]&![unit-podgoricacorps,  INPOLY(montenegro) = 1]&
            ![unit-uzicecorps,  INPOLY(montenegro) = 1]&![unit-
            202artybrig, INPOLY(montenegro) = 1];
      -trigger AllUnitsUSDivArrived = [unit-usdiv, POS = (277, 284),
            13days];
      -trigger FFUSDeployment = [unit-usdiv, POS = (322.0,344.0)];
      -trigger USDivPreparation = [unit-usdiv, POS = (331.1,361.1)];
      -trigger USDivReady = [unit-usdiv, INVENTORY(Readiness) >=
            72hrs];
      -trigger USDivFightsBack = [unit-partisanmontenegro,
            ORDERS(combat) = 1];
      -trigger USReturnToForwardDeployment1 = ([unit-
            partisanmontenegro, ORDERS(combat) != 1]|[unit-
            partisanmontenegro, ORDERS(dead) = 1])&[unit-usdiv,
            STATUS(GSC1) = 1];
      -trigger USReturnToForwardDeployment2 = ([unit-
            partisanmontenegro, ORDERS(combat) != 1]|[unit-
            partisanmontenegro, ORDERS(dead) = 1])&[unit-usdiv,
            STATUS(GSC2) = 1];
      -trigger USReturnToPreparation = ([unit-partisanmontenegro,
            ORDERS(combat) != 1]|[unit-partisanmontenegro, ORDERS(dead)
            = 1])&[unit-usdiv, STATUS(GSC3) = 1];
      -trigger USReturnToReadiness = ([unit-partisanmontenegro,
            ORDERS(combat) != 1]|[unit-partisanmontenegro, ORDERS(dead)
            = 1])&[unit-usdiv, STATUS(GSC4) = 1];
      -statistic decreaseinventoryclassusdivattackbypartisan = global,
            VECTOR(9, 10, 12);
      -statistic decreaseinventorynumberusdivattackbypartisan = global,
            VECTOR(-5, -1, -1);
      -trigger AttackByPartisan = [unit-partisanmontenegro, CONTACT ID
            = 3000]&[unit-partisanmontenegro, ORDERS(combat) = 1];
      -trigger USDivInReadinessPhase = [unit-usdiv,
            ORDERS(usdivpreparation) = 1];

#END


#TRIGGERS

      -trigger AllUnitsFRDivArrived = [unit-frdiv, POS = (322, 187),
            16days];
      -trigger FFFRDeployment = [unit-frdiv, POS = (323.1,262.8)];
      -trigger FRDivPreparation = [unit-frdiv, POS = (381.3,277.7)];
      -trigger FRDivReady = [unit-frdiv, POS = (381.3,277.7), 72hrs];

#END


#TRIGGERS

      -trigger GEDivReadyForAttack =[unit-gediv,
```

```
      ORDERS(gedivopsreadiness) = 1, 3hrs]&[unit-gediv,
      ORDERS(gedivopsreadiness) != 1, 1-[3hrs + 1]];
-trigger USDivReadyForAttack =[unit-usdiv,
      ORDERS(usdivopsreadiness) = 1, 3hrs]&[unit-usdiv,
      ORDERS(usdivopsreadiness) != 1, 1-[3hrs + 1]];
-trigger UKDivReadyForAttack =[unit-ukdiv,
      ORDERS(ukdivopsreadiness) = 1, 3hrs]&[unit-ukdiv,
      ORDERS(ukdivopsreadiness) != 1, 1-[3hrs + 1]];
-trigger FRDivReadyForAttack =[unit-frdiv,
      ORDERS(frdivopsreadiness) = 1, 3hrs]&[unit-frdiv,
      ORDERS(frdivopsreadiness) != 1, 1-[3hrs + 1]];
-statistic gedividnumber = unit-gediv, ID;
-statistic usdividnumber = unit-usdiv, ID;
-statistic ukdividnumber = unit-ukdiv, ID;
-statistic frdividnumber = unit-frdiv, ID;

#END


#TRIGGERS

-trigger TargetSensored = [unit-gepzbrig9, CONTACT ID != 0];
-statistic unitsensoredbypzbrig9 = unit-gepzbrig9, CONTACT ID;
-statistic engagedtarget = unit-gepzbrig9, QLOOKH(TargetContact);
-trigger TargetBeyondBoundary = [unit-engagedtarget,
      INPOLY(attackboundarypzbrig9) = 0];
-statistic distancepzbrig9totarget = unit-epzbrig9&engagedtarget,
      DISTANCE;
-trigger AllWeaponsInFiringRange = [distancepzbrig9totarget <=
      [global, VECTORCOMPONENT(mainfiringrange, 7)]];
-statistic speedtargetpzbrig9 = unit-engagedtarget, SPEED;
-statistic distancelastturn = unit-gepzbrig9,
      QLOOKH(DistanceToTargets);
-trigger RedStartsDelay = [speedtargetpzbrig9 > 0] &
      [distancepzbrig9totarget > distancelastturn];
-statistic redsurrenderthreshold = 0.3;
-statistic percentagetkred = [unit-engagedtarget,
      INVENTORY(Tk)]/[unit-engagedtarget, INVENTORYCAP(Tk)];
-statistic percentageifvred = [unit-engagedtarget,
      INVENTORY(IFV)]/[unit-engagedtarget, INVENTORYCAP(IFV)];
-statistic percentageartyred = [unit-engagedtarget,
      INVENTORY(Arty)]/[unit-engagedtarget, INVENTORYCAP(Arty)];
-trigger RedSurrenders = ([percentagetkred < redsurrender
      threshold]&[percentageartyred < redsurrenderthreshold]) |
      ([percentageifvred < redsurrenderthreshold]
      &[percentageartyred < redsurrenderthreshold]);
-statistic percentagetkpzbrig9 = [unit-gepzbrig9,
      INVENTORY(Tk)]/[unit-gepzbrig9, INVENTORYCAP(Tk)];
-statistic percentageifvpzbrig9 = [unit-gepzbrig9,
      INVENTORY(IFV)]/[unit-gepzbrig9, INVENTORYCAP(IFV)];
-statistic percentageartypzbrig9 = [unit-gepzbrig9,
      INVENTORY(Arty)]/[unit-gepzbrig9, INVENTORYCAP(Arty)];
-statistic pzbrig9threshold1 = 0.8;
-trigger PzBrig9UnderThreshold1 =  ([percentagetkpzbrig9 <
      pzbrig9threshold1]&[percentageartypzbrig9 <
      pzbrig9threshold1]) |([percentageifvpzbrig9 <
```

```
            pzbrig9threshold1]&[percentageartypzbrig9 <
            pzbrig9threshold1]);
      -statistic pzbrig9threshold2 = 0.7;
      -trigger PzBrig9UnderThreshold2 =  ([percentagetkpzbrig9 <
            pzbrig9threshold2]&[percentageartypzbrig9 <
            pzbrig9threshold2]) |([percentageifvpzbrig9 <
            pzbrig9threshold2]&[percentageartypzbrig9 <
            pzbrig9threshold2]);
      -statistic pzbrig9threshold3 = 0.6;
      -trigger PzBrig9UnderThreshold3 =  ([percentagetkpzbrig9 <
            pzbrig9threshold3]&[percentageartypzbrig9 <
            pzbrig9threshold3]) |([percentageifvpzbrig9 <
            pzbrig9threshold3]&[percentageartypzbrig9 <
            pzbrig9threshold3]);
      -statistic minimumfiringrange = global, VECTOR
            COMPONENT(mainfiringrange, 2);
      -trigger PzBrig9BeyondBoundaries = [unit-gepzbrig9,
            INPOLY(attackboundarypzbrig9) = 0];
      -trigger PzBrig9GetsReserves = PzBrig9UnderThreshold3 |
            (PzBrig9UnderThreshold2 & [random0to1 < 0.5]);
      -trigger PzBrig9GetsNoReserves = !PzBrig9GetsReserves;
      -statistic locationofpzbrig9 = unit-gepzbrig9,POS;
      -statistic backtowherepathleft = unit-gepzbrig9,
            QUEUEH(PositionWhenTargetSensored: 2);
      -statistic speedpzbrig9 = unit-gepzbrig9, SPEED;
      -trigger PzBrig9Defends =PzBrig9UnderThreshold3 & [speedpzbrig9 >
            0];
      -trigger DetermineDistanceToTarget = [unit-gepzbrig9,
            ORDERS(approachtargetandstartfiring) = 1] |
            [unit-gepzbrig9, ORDERS(allweaponsfiring) = 1];
      -trigger DetermineLocationOfPzBrig9 =  TargetSensored & [unit-
            gepzbrig9, ORDERS(gepzbrig9attacksobj1) = 1];
            //once only
      -trigger AcquiredContact = DetermineLocationOfPzBrig9;

#END


#UNIT

      id = 1;
      label = 1army;
      x0 = 393;
      y0 = 571;
      display style = SPRITE;
      sprite = 1army;
      classification = land, army, hq;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits3ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawel1army ? AllUnits1ArmyArrived-
                  defensepreparation}, defensepreparation{nochange, 0,
                  STRAIGHTLINE, 0, 0}, ~start;

#END
```

```
#UNIT

      id = 11;
      label = mechcorps;
      x0 = 405;
      y0 =605;
      display style = SPRITE;
      sprite = mechcorps;
      classification = land, army, corps;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits1ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelmechcorps ?AllUnitsMechCorpsArrived-
                  defensepreparation}, defensepreparation{nochange, 0,
                  STRAIGHTLINE, 0, 0}, ~start;

#END


#UNIT

      id = 12;
      label = novisadcorps;
      x0 = 346;
      y0 =619;
      display style = SPRITE;
      sprite = novisadcorps;
      classification = land, army, corps;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits1ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelnovisadcorps ?
                  AllUnitsNoviSadCorpsArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 13;
      label = kragujevaccorps;
      x0 = 432;
      y0 =482;
      display style = SPRITE;
      sprite =  kragujevaccorps;
      classification = land, army, corps;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits1ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelkragujevaccorps ?
```

```
                AllUnitsKragujevacCorpsArrived-defensepreparation},
                defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                ~start;

#END


#UNIT

      id = 14;
      label = sfcorps;
      x0 = 360;
      y0 = 562;
      display style = SPRITE;
      sprite = sfcorps;
      classification = land, army, corps;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  BlueForcesArrive-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 2kmh, OPEN,
                  withdrawelsfcorps ?
                  AllUnitsSFCorpsArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 15;
      label = hqdivbelgrade;
      x0 = 428;
      y0 = 570;
      display style = SPRITE;
      sprite = hqdivbelgrade;
      classification = land, army, division;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnitsMechCorpsArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelhqdivbelgrade ?
                  AllUnitsHQDivBelgradeArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 16;
      label = taskforcedrina;
      x0 = 338;
```

```
      y0 = 685;
      display style = SPRITE;
      sprite = taskforcedrina;
      classification = land, army, division;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnitsMechCorpsArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdraweltaskforcedrina ?
                  AllUnitsTaskForceDrinaArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 17;
      label = taskforcebanat;
      x0 = 387;
      y0 = 639;
      display style = SPRITE;
      sprite = taskforcebanat;
      classification = land, army, division;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnitsHQDivBelgradeArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdraweltaskforcebanat ?
                  AllUnitsTaskForceBanatArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 2;
      label = 2army;
      x0 = 300;
      y0 = 308;
      display style = SPRITE;
      sprite = 2army;
      classification = land, army, hq;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  BlueForcesArrive-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawel2army ?
                  AllUnits2ArmyArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END
```

```
#UNIT

      id = 21;
      label = podgoricacorps;
      x0 = 267;
      y0 = 296;
      display style = SPRITE;
      sprite = podgoricacorps;
      classification = land, army, corps;
      force membership = RED;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits2ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelpodgoricacorps ?
                  AllUnitsPodgoricaCorpsArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 22;
      label = uzicecorps;
      x0 = 346;
      y0 = 465;
      display style = SPRITE;
      sprite = uzicecorps;
      classification = land, army, corps;
      force membership = RED;
      orders =  start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  FirstUnits2ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdraweluzicecorps ?
                  AllUnitsUziceCorpsArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 23;
      label = 202artybrig;
      x0 = 304;
      y0 = 388;
      display style = SPRITE;
      sprite = 202artybrig;
      classification = land, army, brig;
      force membership = RED;
      orders =  start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits2ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 25kmh, OPEN,
```

```
                withdrawel202artybrig ?
                AllUnits202ArtyBrigArrived-defensepreparation},
                defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                ~start;

#END


#UNIT

      id = 3;
      label = 3army;
      x0 = 512;
      y0 = 409;
      display style = SPRITE;
      sprite = 3army;
      classification = land, army, hq;
      force membership = RED;
      sensor vulnerabilities = bluedaytimesensorforredforces,
                bluenighttimesensorforredforces;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                AllUnits2ArmyArrived-withdrawel},
                withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                withdrawel3army ?
                AllUnits3ArmyArrived-defensepreparation},
                defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                ~start;

#END


#UNIT

      id = 31;
      label = niscorps;
      x0 = 490;
      y0 = 375;
      display style = SPRITE;
      sprite = niscorps;
      classification = land, army, corps;
      force membership = RED;
      sensor vulnerabilities = bluedaytimesensorforredforces,
                bluenighttimesensorforredforces;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                AllUnits150ArtyBrigArrived-withdrawel},
                withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                withdrawelniscorps ?
                AllUnitsNisCorpsArrived-defensepreparation},
                defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                ~start;

#END
```

```
#UNIT

      id = 32;
      label = leskovaccorps;
      x0 = 533;
      y0 = 370;
      display style = SPRITE;
      sprite = leskovaccorps;
      classification = land, army, corps;
      force membership = RED;
      sensor vulnerabilities = bluedaytimesensorforredforces,
                  bluenighttimesensorforredforces;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits150ArtyBrigArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelleskovaccorps ?
                  AllUnitsLeskovacCorpsArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 33;
      label = pristinacorps;
      x0 = 454;
      y0 = 331;
      display style = SPRITE;
      sprite = pristinacorps;
      classification = land, army, corps;
      force membership = RED;
      sensor vulnerabilities = bluedaytimesensorforredforces,
                  bluenighttimesensorforredforces;
      orders =    start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits150ArtyBrigArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdrawelpristinacorps ?
                  AllUnitsPristinaCorpsArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 34;
      label = 150artybrig;
      x0 = 528;
      y0 = 324;
      display style = SPRITE;
      sprite = 150artybrig;
      classification = land, army, brig;
```

```
      force membership = RED;
      sensor vulnerabilities = bluedaytimesensorforredforces,
                  bluenighttimesensorforredforces;
      orders =  start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnitsTaskForceTimokArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 15kmh, OPEN,
                  withdrawel150artybrig ?
                  AllUnits150ArtyBrigArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  -start;

#END


#UNIT

      id = 35;
      label = taskforcetimok;
      x0 = 421;
      y0 = 281;
      display style = SPRITE;
      sprite = taskforcetimok;
      classification = land, army, division;
      force membership = RED;
      sensor vulnerabilities = bluedaytimesensorforredforces,
                  bluenighttimesensorforredforces;
      orders =  start{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  AllUnits3ArmyArrived-withdrawel},
                  withdrawel{nochange, 1, CONTINUOUSPATH, 20kmh, OPEN,
                  withdraweltaskforcetimok ?
                  AllUnitsTaskForceTimokArrived-defensepreparation},
                  defensepreparation{nochange, 0, STRAIGHTLINE, 0, 0},
                  -start;

#END


#UNIT

      id = 4;
      label = partisanmontenegro;
      x0 = 306;
      y0 = 371;
      display style = SPRITE;
      sprite = partisanmontenegro;
      classification = land, army, troops;
      force membership = RED;
      sensors = PartisanDetectsBlue;
      orders =    start{nochange, 3, RANDOM POLYGONAL CONFINEMENT,
                  10kmh, 30, partisanareamontenegro ?
                  PartisanDead-dead, PartisanAcquiresTarget-combat},
                  dead{DEAD INVISIBLE, 2, DEFAULT, 0, 0},
                  combat{nochange, 1, FOLLOW, 40kmh, blueid, 180, 1 ?
```

```
                PartisanDead-dead, PartisanEndsFight-start},
                ~start;
//    inventory classes = AT, SmA1, SmA2, Trucks, Troops;
      initial inventory = 1, 5, 2, 1, 8;
      inventory capacities = 1, 5, 2, 1, 8;
      inventory events = USDivFightsBack(none,
                decreaseinventoryclasspartisanmontenegro,
                decreaseinventorynumberpartisanmontenegro);

#END


#UNIT

      id = 1000;
      label = gediv;
      x0 = 600;
      y0 = 124;
      display style = SPRITE;
      sprite = gediv;
      classification = land, army, div;
      force membership = BLUE;
      orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                  BlueForcesArrive-geforcesarrive},
                  geforcesarrive{nochange, 1, STRAIGHTLINE, 0, 0 ?
                  AllUnitsGEDivArrived-forwarddeploymentpreparation},
                  forwarddeploymentpreparation{nochange, 0,
                  STRAIGHTLINE, 0, 0 ?
                  TaskForwardDeployment-geforwarddeployment1},
                  geforwarddeployment1{nochange, 0, CONTINUOUSPATH,
                  15kmh, OPEN, march1gediv ?
                  FFGEDeployment-geforwarddeployment2},
                  geforwarddeployment2{nochange, 0, CONTINUOUSPATH,
                  10kmh, OPEN, march2gediv ?
                  GEDivPreparation-gedivpreparation},
                  gedivpreparation{nochange, 1, STRAIGHTLINE, 0, 0 ?
                  GEDivReady-gedivopsreadiness},
                  gedivopsreadiness{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  MapChange-mapchange},
                  mapchange{nochange, 3, STRAIGHTLINE, 0, 0}, ~start;

#END


#UNIT

      id = 1900;
      label = gepzbrig9;
      x0 = 502;
      y0 = 281;
      display style = SPRITE;
      sprite = gepzbrig9;
      classification = land, army, brig;
      force membership = BLUE;
```

```
      sensors =nighttimesensoring{bluenighttimesensorforredforces ?
                  DayTimeStarts-daytimesensoring},
                  daytimesensoring{bluedaytimesensorforredforces ?
                  NightTimeStarts-nighttimesensoring},
                  ~nighttimesensoring;
      sensor vulnerabilities = reddaytimesensorforblueforces,
                  rednighttimesensorforblueforces;
      orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                  MapChange-mapchange},
                  mapchange{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  TaskGroundForceAttack-gepzbrig9attacksobj1},
                  gepzbrig9attacksobj1{nochange, 0, CONTINUOUSPATH,
                  5kmh, OPEN, attackgepzbrig9obj1 ?
                  TargetSensored-approachtargetandstartfiring},
                  approachtargetandstartfiring{nochange, 1, ATTACH,
                  3kmh, unitsensoredbypzbrig9 ?
                  TargetBeyondBoundary-gepzbrig9attacksobj1,
                  RedStartsDelay-follow,
                  AllWeaponsInFiringRange-allweaponsfiring},
                  allweaponsfiring{nochange, 1, STRAIGHTLINE, 0, 0 ?
                  RedStartsDelay-follow,
                  RedSurrenders-gepzbrig9attacksobj1,
                  PzBrig9UnderThreshold3-pzbrig9defense,
                  //order!PzBrig9UnderThreshold2-pzbrig9delay,
                  PzBrig9UnderThreshold1-pzbrig9requestforreserves},
                  follow{nochange, 1, FOLLOW, 5kmh, engagedtarget, 180,
                  minimumfiringrange ?
                  PzBrig9BeyondBoundaries-gepzbrig9attacksobj1},
                  pzbrig9requestforreserves{nochange, 1, STRAIGHTLINE,
                  0, 0 ?PzBrig9GetsReserves-allweaponsfiring,
                  PzBrig9GetsNoReserves-pzbrig9delay},
                  pzbrig9delay{nochange, 1, WAYPOINT, 5kmh,
                  backtowherepathleft ?
                  PzBrig9Defends-pzbrig9defense},
                  pzbrig9defense{nochange, 1, STRAIGHTLINE, 0, 0},
                  ~start;
      queue names = TargetContact, DistanceToTargets,
                  PositionWhenTargetSensored;
      queue initial states =TargetContact(0), DistanceToTargets(0),
                  PositionWhenTargetSensored(0, 0);
      queue events = AcquiredContact(PUSHH(TargetContact:
                  unitsensoredbypzbrig9)),
                  DetermineDistanceToTarget(PUSHH(DistanceToTargets:
                  distancepzbrig9totarget)),
                  DetermineLocationOfPzBrig9(PUSHH(PositionWhenTargetSe
                  nsored: locationofpzbrig9));

#END


#UNIT

      id = 1100;
      label = gepzgrenbrig1;
      x0 = 513;
      y0 = 289;
```

```
      display style = SPRITE;
      sprite = gepzgrenbrig1;
      classification = land, army, brig;
      force membership = BLUE;
      sensors = nighttimesensoring{bluenighttimesensorforredforces ?
                  DayTimeStarts-daytimesensoring},
                  daytimesensoring{bluedaytimesensorforredforces ?
                  NightTimeStarts-nighttimesensoring},
                  ~nighttimesensoring;
      sensor vulnerabilities = reddaytimesensorforblueforces,
                  rednighttimesensorforblueforces;
      orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                  MapChange-mapchange},
                  mapchange{nochange, 0, STRAIGHTLINE, 0, 0 ?
                  TaskGroundForceAttack-gepzgrenbrig1attacksobj1},
                  gepzgrenbrig1attacksobj1{nochange, 0, CONTINUOUSPATH,
                  5kmh, OPEN, attackgepzgrenbrig1obj1},~start;

#END


#UNIT

      id = 1700;
      label = gepzgrenbrig7;
      x0 = 509;
      y0 = 273;
      display style = SPRITE;
      sprite = gepzgrenbrig7;
      classification = land, army, brig;
      force membership = BLUE;
      sensors = nighttimesensoring{bluenighttimesensorforredforces ?
                  DayTimeStarts-daytimesensoring},
                  daytimesensoring{bluedaytimesensorforredforces ?
                  NightTimeStarts-nighttimesensoring},
                  ~nighttimesensoring;
      sensor vulnerabilities = reddaytimesensorforblueforces,
                  rednighttimesensorforblueforces;
      orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                  MapChange-mapchange},
                  mapchange{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 2000;
      label = ukdiv;
      x0 = 575;
      y0 = 105;
      display style = SPRITE;
      sprite = ukdiv;
      classification = land, army, div;
```

```
      force membership = BLUE;
      orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                  BlueForcesArrive-ukforcesarrive},
                  ukforcesarrive{nochange, 1, STRAIGHTLINE, 0, 0 ?
                  AllUnitsUKDivArrived-forwarddeploymentpreparation},
                  forwarddeploymentpreparation{nochange, 0,
                  STRAIGHTLINE, 0, 0 ?
                  TaskForwardDeployment-ukforwarddeployment1},
                  ukforwarddeployment1{nochange, 0, CONTINUOUSPATH,
                  15kmh, OPEN, march1ukdiv ?
                  FFUKDeployment-ukforwarddeployment2},
                  ukforwarddeployment2{nochange, 0, CONTINUOUSPATH,
                  10kmh, OPEN, march2ukdiv ?
                  UKDivPreparation-ukdivpreparation},
                  ukdivpreparation{nochange, 1, STRAIGHTLINE, 0, 0 ?
                  UKDivReady-ukdivopsreadiness},
                  ukdivopsreadiness{nochange, 0, STRAIGHTLINE, 0, 0},
                  ~start;

#END


#UNIT

      id = 3000;
      label = usdiv;
      x0 = 277;
      y0 = 284;
      display style = SPRITE;
      sprite = usdiv;
      classification = land, army, div;
      force membership = BLUE;
      sensor vulnerabilities = PartisanDetectsBlue ;
      orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                  USForcesArrive-usforcesarrive},
                  usforcesarrive{nochange, 1, STRAIGHTLINE, 0, 0 ?
                  AllUnitsUSDivArrived-forwarddeploymentpreparation},
                  forwarddeploymentpreparation{nochange, 0,
                  STRAIGHTLINE, 0, 0 ?
                  TaskForwardDeployment-usforwarddeployment1},
                  usforwarddeployment1{GSC1, 0, CONTINUOUSPATH, 15kmh,
                  OPEN, march1usdiv ?
                  USDivFightsBack-usdivengagesmentenegropartisans,
                  FFUSDeployment-usforwarddeployment2},
                  usforwarddeployment2{CLEAR GSC2, 0, CONTINUOUSPATH,
                  10kmh, OPEN, march2usdiv ?
                  USDivFightsBack-usdivengagesmentenegropartisans,
                  USDivPreparation-usdivpreparation},
                  usdivpreparation{CLEAR GSC3, 1, STRAIGHTLINE, 0, 0 ?
                  USDivFightsBack-usdivengagesmentenegropartisans,
                  USDivReady-usdivopsreadiness},
                  usdivopsreadiness{CLEAR GSC4, 0, STRAIGHTLINE, 0, 0 ?
                  USDivFightsBack-usdivengagesmentenegropartisans},
                  usdivengagesmentenegropartisans{nochange, 0,
                  STRAIGHTLINE, 0, 0 ?
                  USReturnToForwardDeployment1-usforwarddeployment1,
```

```
                USReturnToForwardDeployment2-usforwarddeployment2,
                USReturnToPreparation-usdivpreparation,
                USReturnToReadiness-usdivopsreadiness},
                ~start;
        inventory classes = Tk, IFV, RV, Mrt, Arty, AT, AAA, SAM, SmA1,
                SmA2, Trucks, Troops, Readiness;
        initial inventory = 246, 123, 24, 18, 84, 100, 24, 12, 10000,
                3000, 1000, 15000, 0;
        inventory capacities = 246, 123, 24, 18, 84, 100, 24, 12, 10000,
                3000, 1000, 15000, 864;
        inventory events = AttackByPartisan(none,
                decreaseinventoryclassusdivattackbypartisan,
                decreaseinventorynumberusdivattackbypartisan),
                USDivInReadinessPhase(none, Readiness, 1);

#END


#UNIT

        id = 4000;
        label = frdiv;
        x0 = 322;
        y0 = 187;
        display style = SPRITE;
        sprite = frdiv;
        classification = land, army, div;
        force membership = BLUE;
        orders =    start{nochange, 3, STRAIGHTLINE, 0, 0 ?
                BlueForcesArrive-frforcesarrive},
                frforcesarrive{nochange, 1, STRAIGHTLINE, 0, 0 ?
                AllUnitsFRDivArrived-forwarddeploymentpreparation},
                forwarddeploymentpreparation{nochange, 0,
                STRAIGHTLINE, 0, 0 ?
                TaskForwardDeployment-frforwarddeployment1},
                frforwarddeployment1{nochange, 0, CONTINUOUSPATH,
                15kmh, OPEN, march1frdiv ?
                FFFRDeployment-frforwarddeployment2},
                frforwarddeployment2{nochange, 0, CONTINUOUSPATH,
                10kmh, OPEN, march2frdiv ?
                FRDivPreparation-frdivpreparation},
                frdivpreparation{nochange, 1, STRAIGHTLINE, 0, 0 ?
                FRDivReady-frdivopsreadiness},
                frdivopsreadiness{nochange, 0, STRAIGHTLINE, 0, 0},
                ~start;

#END


#UNIT

        id = 9999;
        label = countsreadiness;
        display style = NEVERDISPLAY;
        force membership = BLUE;
```

```
      queue names = BlueUnitsReadyForAttack;
      queue initial states = BlueUnitsReadyForAttack(0);
      queue events =
            GEDivReadyForAttack(GROWH(BlueUnitsReadyForAttack:gedividnu
            mber)),
            USDivReadyForAttack(GROWH(BlueUnitsReadyForAttack:usdividnu
            mber)),
            UKDivReadyForAttack(GROWH(BlueUnitsReadyForAttack:ukdividnu
            mber)),
            FRDivReadyForAttack(GROWH(BlueUnitsReadyForAttack:frdividnu
            mber));

#END


#SENSOR

      id = 41;
      label = PartisanDetectsBlue;
      polygon = -5.0,5.0, 5.0,5.0, 5.0,-5.0, -5.0,-5.0;
      detection probability = 1;

#END


#SENSOR

      id = 9701;
      label = bluedaytimesensorforredforces;
      polygon =  0.0,24.0, -20.0,0.0, 0.0,-19.5, 20.0,0.0;
      detection probability = 0.9;

#END


#SENSOR

      id = 9702;
      label = bluenighttimesensorforredforces;
      polygon = 0.0,24.0, -20.0,0.0, 0.0,-19.5, 20.0,0.0;
      detection probability = 0.7;

#END


#SENSOR

      id = 9702;
      label = reddaytimesensorforblueforces;
      polygon = 0.0,4.5, -2.5,0.0, 0.0,-1.7, 2.5,0.0;
      detection probability = 0.7;

#END
```

```
#SENSOR

      id = 9704;
      label = rednighttimesensorforblueforces;
      polygon = 0.0,3.0, -1.5,0.0, 0.0,-1.2, 1.5,0.0;
      detection probability = 0.5;

#END


#OUTPUT

      name = targetssensoredbypzbrig9;
      filename =  targetssensoredbypzbrig9.out;
      control trigger = TargetSensored;
      output after turn = 10000;
      objects = unitsensoredbypzbrig9;

#END
```

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